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ENVIRONMENTAL AND SOCIO-ECONOMIC SERVICES

KEENLEYSIDE POWERPLANT PROJECT
ENVIRONMENTAL IMPACT EVALUATION
WATER USE STUDY

JANUARY 1984

KERR WOOD LEIDAL ASSOCIATES LTD.
Consulting Engineers

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This impact assessment is based on the "Keenleyside Powerplant Project Engineering Description" prepared in November 1982. Since that time, ongoing planning and design studies have resulted in some changes that would affect the project description. The principal changes are as follows:

- In-service date has changed from 1992 to 1994 and the optional in-service date of 1990 is no longer being considered.

- Installed capacity has changed from 210 MW to 180 MW with corresponding changes to powerhouse design.

The above changes have been incorporated in the report only where they would affect the results of the impact assessment.

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SYNOPSIS

1. "Water Use" is considered to mean either :

   - diversion of water from the Lower Arrow Lake and Columbia River system for domestic consumption, irrigation of land, or industrial processes

   - disposal of wastewater to the Columbia River system from adjacent communities or industry

2. While fourteen potential water users are identified within the study area, only four presently make direct use of the Columbia River system, one being the B. C. Hydro - Hugh Keenleyside Dam.

3. Key parameters for assessing possible impact of the Keenleyside Powerplant Project (KPP) on water use both during and after construction include:

   - minimum discharge rates in the river

   - minimum water levels in the reservoir and river

   - suspended solids and turbidity levels in both the reservoir and river

4. The existing pump station on Lower Arrow Lake that provides bulk water supply to B. C. Timber and the City of Castlegar is the only facility identified as being possibly vulnerable to impact as a result of either reservoir siltation or extreme low water levels (following construction).

5. With reservoir levels maintained above the minimum design El. 420m for future operation (i.e. under Regime 2), the Keenleyside Powerplant Project operation would result in no impact on water use.

6. The powerplant and related facilities would be constructed "in the dry" behind cofferdams, with no discharge of excavated material to the river.

7. Cofferdam construction would be scheduled for low reservoir level periods, and would also be constructed (and later removed) "in the dry".

8. With construction "in the dry", the Keenleyside Powerplant Project is likely to result in no impact on water use.

9. Possible concerns relative to water quality in Lower Arrow Lake relate to operation of the proposed borrow pit and spoil areas located on the north bank a short distance upstream.

10. With implementation of a sediment containment plan in borrow pit and spoil areas to control local runoff, there would likely be no impact on water use.

11. Implementation of the Keenleyside Powerplant Project, either in conjunction with or after Murphy Creek Project, is likely to result in no additional impacts to those previously identified for that project.

KEENLEYSIDE POWERPLANT PROJECT
ENVIRONMENTAL IMPACT EVALUATION
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1. INTRODUCTION

1.1 Background

B. C. Hydro is considering the addition of Keenleyside power generation to the Murphy Creek Project, with possible implementation of the powerplant construction in advance of the Murphy Creek Project. Figure 1-1 shows the general relationship of these projects within the Columbia River Drainage Basin.

Provisions for generating facilities at Hugh Keenleyside Dam were investigated during the original design studies, however it was decided that they not be included in the initial construction. Feasibility level studies of the Murphy Creek Project have recently been completed, and because there is considerable interdependence between Keenleyside and Murphy, a prefeasibility level study for Keenleyside was undertaken to permit an overall optimization of both projects.

This water use study comprises one section of several environmental and socio-economic studies associated with the Keenleyside Powerplant Project. It is based on the subsequent optimization study, with a normal reservoir operating level for Murphy Creek of El. 424m.

1.2 Scope of Assignment

The Terms of Reference provided by B. C. Hydro are included as Appendix 1. The objectives of this study comprise:

- identification of water use in the vicinity of Keenleyside
- review of potential impacts on water systems during the project construction

The terms of reference are limited to water use by communities, individuals, institutions and industry. The fishery resource aspect is covered under a separate study.

The assessment includes:

1. Preparation of an inventory which identifies all water systems and licences in the Lower Arrow Lake near the Hugh Keenleyside Dam, and in the Columbia River between Hugh Keenleyside and the proposed Murphy Creek Dam.
2. Description of the water intake location and type for each system.
3. Review of the proposed construction locations and techniques for the Keenleyside Powerplant Project.
4. Review of potential turbidity levels resulting from construction.
5. Analysis of potential impacts of turbidity on known water systems.
6. Identification of other water quality parameters, if any, which could cause impacts on water systems in the vicinity.

7. Identification of possible mitigation measures to reduce impacts to water systems in the vicinity.

Kerr Wood Leidal Associates Ltd. was retained by letter dated March 17, 1982 to prepare the "Water Use Study" component for the overall Environmental Impact Evaluation.

1.3 Study Area

The study area is shown on Figure 1-2. It consists of all lands and waters below elevation 500m, extending upstream of the Hugh Keenleyside Dam 10 km (i.e. Lower Arrow Lake), and downstream about 34 km to the proposed Murphy Creek Dam (i.e. the Columbia River).

Local communities of the Columbia Valley within the study area include the following:

- Balfour Subdivision	Regional District of Central Kootenay
- Robson Irrigation District	
- West Raspberry Irrigation District	
- East Raspberry Improvement District	
- City of Castlegar	
- Ootischenia Improvement District	
- Blueberry Irrigation District	
- Fairview Subdivision (Poupore Improvement District)	
- Brilliant Waterworks District	
- Genelle (China Creek) Improvement District	Regional District of Kootenay Boundary

The communities of Balfour, Robson, West and East Raspberry and Brilliant are located on the north side of the Columbia

River opposite the BC Timber Ltd. Mill and North Castlegar.

Existing development in Robson is located on a relatively flat bench above the Columbia River. This bench, in turn, backs up against a steep mountainside that is effectively undevelopable.

Existing development in the Raspberry Irrigation District is located mainly on the sloping hillside on the west side of Norns (Pass) Creek. In East Raspberry, existing development is located mainly on the bench above the mouth of Norns (Pass) Creek, although there is some new development taking place on the hillside to the east.

Existing development in Brilliant is located on a flat bench adjacent to the Columbia River just above its confluence with the Kootenay River.

The Community of Ootischenia is located on the east side of the Columbia River south of the confluence with the Kootenay River. Selkirk College is located in the immediate vicinity of this confluence. Both are located on relatively level bench lands.

The Blueberry Creek community is located on the west side of the Columbia River below Highway 3, and immediately south of the City of Castlegar. It is located on a level bench high above the river.

The Fairview subdivision is located a short distance to the south of Blueberry, adjacent to but above Highway 3.

Genelle (China Creek) is located about 15 kilometres north of Trail, with almost all development between the west bank

of the river and Highway No. 3. The community is divided between two level bench lands, the lower near the river, and the upper being adjacent to the highway.

Above the Hugh Keenleyside Dam the only community-type development is the camping and day facilities associated with Syringa Provincial Park.

BC Timber Ltd., with both its pulpmill and sawmill divisions, is the major industry within the study area. It is located downstream and within close proximity (i.e. between 2 and 4 km) of the Hugh Keenleyside Dam.

Cominco Ltd. is located below the proposed site of the Murphy Creek Dam, and is therefore outside the study area.

1.4 Study Approach

For purposes of this water use study, the Phase I report previously prepared by our firm on "Impact of the Murphy Creek Hydroelectric Dam on Municipal Services in the Castlegar Region", and supplemented by additional information presented in the Phase 2 report (prepared by Dayton & Knight Ltd.), provides most of the information on existing systems. Work additional to that presented in previous studies includes a tabular summary of all water licences within the study area.

B. C. Hydro (Reference 1) has supplied information on the project description, operating regime and schedules.

Since the Keenleyside Powerplant Project reports are intended to be read in conjunction with the Murphy Creek Project documents, duplication of baseline data is avoided wherever possible. On the other hand discussions are intended to clearly specify the difference between two

scenarios - that is, the "no Murphy case" and the "Murphy 424 case".

The study approach involved:

- review of previous studies for the B. C. Hydro - Murphy Creek Project
- request to Ministry of Environment - Water Management Branch for a current inventory of water licences
- similar request to Ministry of Environment - Waste Management Branch relative to existing permits for discharge
- review of B. C. Hydro proposals relative to construction locations, techniques, and schedules
- prediction as to potential turbidity levels and other possible water quality parameters
- assessment of potential impacts
- identification of possible mitigation measures
- preparation of report

1.5 Acknowledgements

Information and assistance received from the following individuals and organizations has been most valuable in the preparation of this report, and is gratefully acknowledged:

- D. P. Mahony (Monenco)

- Water Management Branch, Nelson
  J. McLaren, P. Eng.

- Waste Management Branch, Nelson

References used for review and background material in this study are listed in Appendix 2.

2. INVENTORY OF WATER USE

2.1 General

For the purpose of this study "water use" is considered to mean either:

- diversion of water from the Lower Arrow Lake and Columbia River system for domestic consumption, irrigation of land, or industrial processes

- disposal of wastewater to the Lower Arrow and Columbia River system from adjacent communities or industry

The relative locations of those communities and other specific users of the Lower Arrow Lake and Columbia River system within the study area are shown on Figure 1-2.

Table I (i.e. slightly expanded from Table I in Ref. No. 2) includes a summary of all known community and other major water users.

2.2 Existing Systems

Water Supply

A brief description of the various water supply systems in the study area (excepting Syringa Park & BC Timber Ltd.) is presented in Reference No. 2. Figure 2-1 identifies the systems and shows boundaries for their respective service areas.

For purposes of bulk water supply, some users operate combined systems, and they are grouped as follows:

TABLE I - SUMMARY CLASSIFICATION OF EXISTING SYSTEMS

USER	APPROX. NO. OF DU'S*	CATEGORY & CLASSIFICATION	
		WATERWORKS	WASTEWATER
BC Timber Ltd.	-	private	private
Syringa Prov. Park	-	community	community
B.C. Hydro - Keenleyside	-	private	-
Balfour Subdivision	45	community	individual**
Robson	348	community	individual
West Raspberry	81	community	individual
East Raspberry	34	individual	individual
Brilliant	50	community/ private	individual
Selkirk College	-	community	community
Ootischenia	160	community	individual
Castlegar	2220	community	community
Blueberry	210	community	individual
Fairview Subdivision	40	community	individual
Genelle - China Creek	200+	community	individual

Notes:

* DU means "dwelling Unit".

** Individual means by use of "septic tanks".

- BC Timber Ltd. - City of Castlegar
- Robson - West Raspberry

Of the fourteen users listed in Table 1, only the BC Timber Ltd. - City of Castlegar grouping diverts water directly from the Columbia System. B. C. Hydro maintains its own water supply in the Hugh Keenleyside Dam, including a small pump for domestic water supply and larger pumps for fire protection. They are located on the south side of the dam, with a 400 mm diameter intake and filters.

The Syringa Provincial Park supply consists of a groundwater well, with a gravity system from Syringa Creek for emergency backup.

The BC Timber Ltd. - City of Castlegar water supply pumping station is located on the south bank of the reservoir approximately 800 metres upstream of the dam. Originally constructed by B. C. Hydro for Celgar (later known as Cancel, and now BC Timber Ltd.) as a mitigation measure prior to construction of the Hugh Keenleyside Dam, it comprises the following:

- an existing pumphouse constructed in 1965, and designed for a total of six pumping units, five now having been installed

- five deep well turbine Fairbanks-Morse Inc. pumps, 38,000 Lpm (10,000 USgpm) capacity at rated total head of 87 metres (285 ft.)

- 4 stage 28XHC bowl assemblies, with approximately 27 metres of 600mm diameter column

- 900 HP, 900 rpm Canadian General Electric hollow shaft motors

- the main floor of the pumphouse is El. 442.4m with sump bottom El. 412.0m

- the pumping units draw water from a wet well connected to the intake pipe from the lake; water levels in the wet well vary between El. 416.9m and El. 440.1m

- the pumping units are protected by travelling water screens located in the pumphouse, and equipped with 6mm mesh

- intake structure consists of a metal box with large screens and 168mm diameter pipe

- safe minimum reservoir water level is El. 416.0m without creating pump supply problems

Figure 2-2 includes a plan and profile showing the general proximity of the BC Timber Ltd. - City of Castlegar water supply pumping station and intake pipe to the dam.

Table 2 includes a summary of existing water supply sources, and Table 3 includes a summary of existing water licences.

Table 3 has been compiled from Water Rights Maps for the study area. It should be noted, however, that many water licences are presently inactive, (for example, in the City of Castlegar) and this information is not readily available. It should also be noted that only licences for intakes located up to El. 500m are listed.

TABLE 2 - SUMMARY OF EXISTING WATER SUPPLY SOURCES

USERS	SOURCE
Syringa Prov. Park	Well (plus Syringa Creek for emergency backup)
B.C. Hydro - Keenleyside Dam	Lower Arrow Lake
BC Timber Ltd.	Lower Arrow Lake
City of Castleger	Lower Arrow Lake (plus 2 wells for emergency backup)
Balfour Subdivision	Wells
Robson - W. Raspberry	Pass (Norns) Creek
East Raspberry	Wells
Brilliant	Wells
Selkirk College	Wells
Ootischenia	Wells and small creeks
Blueberry	Blueberry Creek
Fairview Subdivision	Springs
Genelle - China Creek	China Creek plus well

TABLE 3 - SUMMARY OF EXISTING WATER LICENCES*

LOCALITY	WATER SOURCE	NO. OF LICENCES
Balfour	Luscher Brook	1
	Lauriente Creek	3
	Webster Spring	1
	Luttman Brook	2
	Walker Creek	4
	Bjerkness Spring	1
	McHardy Creek	1
	Balfour Creek	3
	Columbia River	1
	Cab Creek	1
	Berry Creek	1
	Waldie Creek	2
	Boolinoff Spring	1
	Robson Creek	1
	Turick Spring	1
Robson Irrigation District	Joe Spring	1
	Robson Creek	1
	Ruth Spring	1
	Eva Spring	1
	Clyde Spring	1
	Birch Springs	1
	Clements Swamp	1
	Norns Creek	1
Raspberry Irrigation District	Norns Creek	2

TABLE 3 - SUMMARY OF EXISTING WATER LICENCES

LOCALITY	WATER SOURCE	NO. OF LICENCES
East Raspberry Irrigation District	Lang Creek	2
	Allison Brook	1
	Ozeroff Brook	1
	Vandite Creek	3
	Greely Spring	1
	Graziani Spring	1
	Doucette Spring	1
	Norns Creek	1
Ootischenia Improvement District	Columbia River	7
	Ootischenia Creek	1
	Phillips Creek	1
	Iron Creek	2
	Kazakoff Spring	1
	Harshenin Spring	1
	Betty Spring	1
	Negreiff Spring	1
	Cai Creek	1
Castlegar	Lower Arrow Lake	1
	Columbia River	9
	Hyde Brook	1
	Billkoff Spring	1
	Koffbill Spring	1
	Koff Spring	1
	Salekin Spring	1

TABLE 3 - SUMMARY OF EXISTING WATER LICENCES Page 3

LOCALITY	WATER SOURCE	NO. OF LICENSES
Castlegar	Mild Spring	1
	Glaspell Spring	1
	Farmer Creek	3
	Stral Spring	1
	Edgar Creek	1
	Hirst Creek	2
	Bloomer Creek	3
	Linda Spring	1
	Southwood Spring	2
	Mutcha Creek	1
	Horcoff Spring	1
	Drain Spring	1
	Jane Spring	1
	Sad Spring	1
	Gootfriend Spring	1
	Myrtle Spring	1
	Carl Spring	1
	Merry Creek	3
	Faisal Creek	1
	Owles Spring	1
	Ostrow Spring	1
	Dumont Spring	1
	Healman Spring	1
	Healman Creek	1
	Schofield Creek	1

TABLE 3 - SUMMARY OF EXISTING WATER LICENCES

LOCALITY	WATER SOURCE	NO. OF LICENSES
Castlegar	Maitland Spring	1
	Beresford Spring	1
	Mapleleaf Spring	1
Blueberry Creek Irrigation District	Jackson Spring	1
	Blueberry Creek	1
Poupore	Petersen Brook	2
	Mads Brook	1
	China Creek	2
China Creek/Genelle Improvement District	China Creek	4
	Alfred Brook	1
	Steinburg Brook	1
	Steinburg Spring	1
	Clark Spring	1
	Columbia River	1
	Horlick Creek	1
Champion Creek	Champion Creek	1

* Compiled from maps and information provided by Water Management Branch, Ministry of Environment. Note that water licences are not necessarily currently active.

Wastewater Disposal

All small communities within the study area treat wastewater on an individual basis by use of septic tanks, with effluent disposal to the ground.

The Syringa Provincial Park Campsite includes three separate septic tank and field systems plus pump out facilities.

Treated wastewater discharge sites to the river system are shown on Figure 2-1, and limited to the following four sources:

- BC Timber Ltd.
- City of Castlegar - North
- City of Castlegar - South
- Selkirk College

Table 4 includes a summary of all existing discharge permits, with copies of the various permits included as Appendices 3 to 5, inclusive.

The City of Castlegar is served by two wastewater collection and treatment systems - one in the north and one in the south, with treated effluent discharged to the river from both plants. The system is described in some detail in both References 2 and 3.

The Selkirk College treatment system is described in Reference 3.

The BC Timber Ltd. complex includes separate treatment of domestic and industrial wastes. Domestic wastewater receives biological secondary treatment, while the process wastewater receives primary treatment prior to discharge to the Columbia River (Reference No. 6).

Pulp mill wastes are noted for their acidic, caustic and fibrous content, as well as for their effect in discolouring water. It is in this respect BC Timber Ltd. added a fibre salvage system to the treatment process several years ago.

The Water Quality Study prepared by IEC in 1982 (as part of the Murphy Creek Project Assessment) estimates mill effluent discharge at 1.4m^3/sec, yielding typical surface dilution factors of 30 to 200 depending on river velocity, depth and temperature.

TABLE 4 - SUMMARY OF EXISTING WASTEWATER DISCHARGE PERMITS

PERMITTEE	PERMIT NO.	TYPE OF DISCHARGE
City of Castlegar (North Treatment Plant)	PE00080	Municipal
Selkirk College	PE00141	Municipal
Canadian Cellulose (BC Timber Ltd.)	PE01272	Pulp Mill
Canadian Cellulose (BC Timber Ltd.)	PE01273	Municipal
City of Castlegar (South Treatment Plant)	PE04008	Municipal
B.C. Hydro & Power Authority	PE04460	Municipal
Canadian Cellulose (BC Timber Ltd.)	PE05594	Cooling Water

3. IMPACT ON WATER USE

3.1 General

The focus of this study is limited to impact during the construction period. Key parameters for assessing possible impact of construction on water use include:

- minimum discharge rates in the river
- minimum water levels in the lake and river
- suspended solids and turbidity levels in both the lake and river

Based on the inventory presented in the previous section, systems identified as being possibly vulnerable to impact during construction include:

- the common bulk water supply to BC Timber Ltd. and the City of Castlegar, with the intake located about 800 metres upstream from the existing dam
- the treated wastewater discharge to the river from BC Timber Ltd. industrial complex located immediately downstream of the damsite
- further downstream, treated wastewater discharges to the river from two City treatment plants and that for Selkirk College

The question to be resolved is whether the proposed construction or operation of the powerplant could: (1) increase suspended sediment and turbidity levels in the Lower Arrow Lake to a critical point, thereby resulting in impact on the combined City - BC Timber Ltd. water supply; (2) reduce water levels above the dam to a critical level which would interrupt operation of the City - BC Timber Ltd. water supply; and (3) reduce water levels or discharge in the river to a critical level which would result in inadequate dilution of wastewater discharges for BC Timber Ltd., the City, and Selkirk College.

3.2 Description of Powerplant Facilities

Features of the proposed generating facilities are shown on Figure 3-1, and described in Reference No. 1. The major construction components which represent a potential impact on the lake - river system include the following:

- approach channel leading from reservoir to powerplant
- powerplant located between end of existing bulkhead and Robson - Broadwater Highway, complete with three intake bays
- tailrace channel leading from the powerhouse sluiceway and low level ports to the river
- tailrace weir, comprising the downstream cofferdam, which provides a controlled tailwater level prior to completion of the Murphy Creek Project
- public access road reconstruction connecting the dam to the Robson - Broadwater Highway

3.3 Methods of Construction

The proposed construction schedule, sequence, methods and plant are described in Reference No. 1. Those major activities with potential impact on water use are briefly summarized as follows:

- construction period lasting nearly 6 years
- in Year 1, proceed with upstream cofferdam
- in Year 1, commence work on downstream earth and rockfill cofferdam, with completion by Year 2
- while cofferdams under construction, proceed with main excavation above El. 442m
- in early Year 6, remove the upstream cofferdam during the low reservoir period; modify downstream cofferdam for use as a tailrace weir until Murphy Project in service

From Reference No. 1 it is noted that:

"For the cofferdam and excavation contractor, the main activity would involve the placement of some 300,000 m^3 of rock and earthfill in the upstream and downstream cofferdams plus the excavation and disposal of some 1.6 x $10^6 m^3$ (in situ) of silts, sands, gravels and rock. The only suitable spoil areas for the excavated materials appear to be on the north bank of the reservoir approximately 1 to 3 km upstream of the dam."

"Because the approach channel would cut through the impervious blanket which currently prevents seepage through the left abutment past the concrete structures and through the underlying sands and gravels past the earthfill dam, a new blanket would have to be connected in the vicinity of the cofferdam and extended along the invert and left bank of the channel.

All of the critical work on the extension of the impervious blanket would be carried out in the dry behind the cofferdam under controllable conditions. The existing blanket throughout this area was originally placed in the dry and, therefore, the details of its construction are well known."

In summary, the powerplant and related facilities would be constructed "in the dry" behind the cofferdam. Excavated material would be removed; no discharge of excavated material to the river is anticipated.

3.4 Reservoir Levels and Discharges

As a result of the addition of generating facilities at Keenleyside and the construction of the downstream Murphy Creek Project, the existing operating regime (i.e. referred to as Regime 1) for the Arrow Lakes Reservoir and Hugh Keenleyside Dam would likely be changed. Although the powerplant may operate initially under conditions close to Regime 1 (as shown on Figure 3-2), it is expected that Regime 2 (as shown on Figure 3-3) would be much more representative of long-term operation. (Reference No. 1)

Compared to existing conditions with no generating facilities, the most significant changes in operation would be the reduced drawdown of the Arrow Lakes Reservoir, a more uniform discharge throughout the year and, most importantly, the

diversion of much of the discharge from the sluiceway to the powerplant. With the powerplant installed and operated according to Regime 2, approximately 73 percent of the total releases would be made through the powerplant.

For Regime 2, the minimum operating level of El. 420m would only be necessary during years of extreme potential for flooding in order to ensure sufficient reservoir capacity is available during the spring freshet.

The most significant changes in tailwater levels downstream of Keenleyside would be due to the reservoir created by Murphy Creek Project which, with a nominal reservoir level of El. 424, would raise the average natural tailwater level at Keenleyside by about 4m.

3.5 Water Quality During Construction

All construction work is planned for completion "in the dry" by scheduling certain critical activities with normal low reservoir level periods.

The upstream cofferdam construction, for example, would commence in January and be complete by the end of May. From Reference No. 1 it is noted that:

While the Arrow Lakes Reservoir is drawn down early in the year some of the existing sand and gravel fill overlying the till blanket would be removed allowing connection of the impervious core of the cofferdam within the existing till blanket. Because of the annual reservoir drawdown only a small amount of rockfill for the toe of the cofferdam would have to be placed under water. The remainder of the earth and rockfill would be placed in the dry as the reservoir begins to refill.

The foregoing is illustrated in cross-section on Figure 3-4.

Removal of the upstream cofferdam is scheduled for a similar low reservoir level period.

Work on the downstream cofferdam is scheduled for a February to March construction period. All work would be performed "in the dry" by first placing a rockfill dyke around the site, and then excavating the area behind the dyke in order to construct the dam. The crest of the dyke would be above El. 420.0m (i.e. the average existing tailwater level) as illustrated on Figure 3-4.

Normal good design and construction practice relative to restoration and/or creation of new channel sections and bank stability in areas immediately upstream of the powerplant should minimize any impact on water quality during the initial operating period, with turbidity and suspended solids expected to be well within limits experienced during the average year.

Under the Treaty, downstream flood control is only provided after May 1st each year. Therefore during construction of the upstream cofferdam, any unusually high flood flows could be passed through the dam with a negligible effect on construction activities and water quality.

Possible concerns relative to water quality in the Arrow Lakes Reservoir are directed towards two activities:

- a proposed borrow area for concrete aggregates on the north bank, about 1 to 2 km upstream of the dam

- and disposal of excavated spoil material (i.e. silts, sands and gravels), possibly in this same general area

These activities could potentially yield significant quantities of sediment to the reservoir unless standard engineering protective measures are implemented as part of a sediment containment plan.

Seven potential spoil areas are shown on Figure 3-5. They comprise two sites (Areas 11 and 12) above the Robson-Broadwater Highway and five sites (Areas 4, 5, 6, 7 and 10) on the north shore of the Arrow Lakes Reservoir.

From Reference No. 1, it is noted that:

> *Areas 11 and 12 above the Highway are old borrow areas that would be refilled to approximately the original topography. Area 10 is also an old borrow area but lies between the north bank of the reservoir and a long, slender island some 80m offshore (at full reservoir). The remaining four areas would be developed by first constructing retention dykes during the annual low reservoir period. These dykes would be constructed in the dry at a foundation level of about El. 430 or higher and would be extended upward, as the reservoir refills, to above maximum reservoir level. Granular and rockfill protection would be placed on the face of these dykes to prevent erosion.*
>
> *The spoil material would be deposited between the dykes and the Robson-Broadwater Highway to levels not exceeding the highway grade.*

The space between Spoil Areas 4 and 5 is currently used to some extent as an informal beach area. Disturbance of this area would be avoided.

Since a number of the spoil sites are old borrow areas, they would not require clearing. In addition, since dykes would be constructed around four spoil areas, these measures should be effective in reducing sedimentation in the lake within acceptable limits.

3.6 Impacted Areas - No Murphy Case

For the "no Murphy case," potential impact on water use is limited to the following:

- BC Timber Ltd. - City of Castlegar water supply
- BC Timber Ltd., City of Castlegar and Selkirk College wastewater effluent discharges

All other water use in the area relates to systems separate from the mainstream of the Columbia system, and are therefore not subject to possible impact by the Keenleyside Powerplant Project.

With construction "in the dry", and both reservoir levels and discharge maintained in accordance with Regime 1, the Project results in no change to the river flow regime, and therfore no impact on water use.

Similarly, there is no impact for the future Regime 2 since the minimum reservoir level of El. 420m exceeds the "safe minimum resevoir level" of El. 416m for operation of the BC Timber Ltd. - City of Castlegar water supply pumping station; and since the minimum tailwater level of El. 420m is essentially unchanged from Regime 1.

The operation of borrow pits and spoil areas represent potential sources of siltation which could affect BC Timber Ltd. - City of Castlegar water supply. Based on the information presented in the previous section, however, it is reasonable to expect that proposed control measures would eliminate any impact.

3.7 Impacted Areas - Murphy 424 Case

Impact on water use relative to the Murphy Creek Project has been identified in earlier reports (i.e. Reference Nos. 2 and 3).

Implementation of the Keenleyside Powerplant Project coupled with the Murphy Creek Project "424 Case" would not likely result in any additional impact.

Those comments and concerns already presented relative to the "no Murphy case" apply equally to the "Murphy 424 Case".

3.8 Mitigation of Impacts

Based on proposed construction of the Keenleyside Powerplant Project "in the dry", and with reservoir water levels higher than the minimum El. 416m for operation of the existing Lower Arrow Lake pumping station, there would be no impact on water use from the Columbia River system. This finding is applicable to the project with or without the Murphy Creek (424) Project.

In view of the foregoing, no mitigation measures are presented within the context of this report.

4. CONCLUSIONS

Based on the information presented in this report, the key conclusions relative to impact on water use are:

1. Key parameters for assessing possible impact of the Keenleyside Powerplant Project on water use (both during and after construction) are:

   - minimum river discharge rates
   - minimum river and reservoir water levels
   - reservoir and river suspended solids and turbidity levels

2. The powerplant and all related facilities would be constructed "in the dry".

3. The approach proposed by B. C. Hydro for utilizing borrow pit and spoil areas located on the north bank and upstream of the dam would be effective in preventing sediment from entering Lower Arrow Lake.

4. Reservoir levels under the proposed future Regime 2 operation would be higher than the minimum El. 416m for operation of the existing BC Timber Ltd. - City of Castlegar water supply pumping station.

5. The Keenleyside Powerplant Project is likely to result in no impact on water use (or wastewater disposal), whether treated in isolation, with, or after the Murphy Creek Project.

KEENLEYSIDE POWERPLANT PROJECT
ENVIRONMENTAL IMPACT EVALUATION
WATER USE STUDY

APPENDIX 1: TERMS OF REFERENCE

OCTOBER 1982
REVISED JANUARY 1984

3 February 1982

KEENLEYSIDE POWER GENERATION

Terms of Reference
ENVIRONMENTAL STUDIES

1.0 INTRODUCTION

Prior to signing the Columbia Treaty in 1961 and its ratification in 1964, numerous studies were made of the hydroelectric development of the Columbia River in Canada. The Treaty between the United States and Canada led to the construction of Mica and Hugh Keenleyside projects on the Columbia River in Canada. The Revelstoke project on the Columbia, now under construction, is not a Treaty project.

Keenleyside dam was constructed at the outlet of Lower Arrow Lake near Castlegar, above the confluence of the Kootenay River. The project, completed in 1968, was for the purpose of water storage and contained no power generation facilities.

Since 1977, B.C. Hydro has been studying the Murphy Creek project, which would be located on the Columbia River, 35 km downstream of Keenleyside dam. Three reservoir elevations were studied; the lowest level (424 m) would allow the installation of a powerhouse at Keenleyside. The Murphy Creek project, if built, would not be a Treaty project.

Environmental information on the proposed Murphy Reservoir has been collected for levels 430 m, 427 m and 424 m. These terms of reference are for detailed environmental studies of the addition of Keenleyside power generation to the Murphy Creek 424 m case. All environmental studies should assume Murphy 424 m and identify any changes or

incremental impacts caused by the Keenleyside project. All discussions should clearly specify the differences between the two scenarios.

The Keenleyside reports are intended to be read in conjunction with the Murphy Creek documents, and therefore should avoid duplication of baseline data wherever possible.

Information on the study area without further hydroelectric development, and on the impacts of Murphy 424 m, is available in existing Murphy Creek environmental reports.

Study objectives, organization, liaison and methodology are the same as described in the Murphy Creek terms of reference.

B.C. Hydro will supply information on project description and schedules, operating regime, and will make available environmental reports on Murphy Creek.

2.0 STUDY AREA

The study area consists of all lands and waters below 500 m elevation within 10 km of Keenleyside dam. The study area for fisheries should include the lower Arrow Reservoir and the future Murphy Creek Reservoir (or the Columbia River as far south as Trail). The study area for socio-economics and resource evaluation should include local communities of the Columbia Valley.

(a) Reporting Procedures

Written reports will be required for all sections of the studies. Five draft reports and 45 final reports will be required. Draft reports will be prepared and submitted for review by B.C. Hydro and, where necessary, by outside experts before they are accepted. All final reports shall be in a form suitable for release to government agencies and the public. Following completion of all

the reports for the sections, B.C. Hydro will prepare an integrated summary report in consultation with the authors of the sections and outside experts, where necessary.

(b) Studies Schedule

The studies will be undertaken in early 1982. A target schedule showing specific deadlines will be issued for each section.

(c) Studies Sections

The following are guidelines for each of the sections. These guidelines distinguish between inventory and assessment work. Where feasible this distinction should be made in report preparation.

Study sections are:

A Aquatic Resources
B Vegetation, Agriculture and Forestry
C Wildlife
D Heritage Resources
E Socio-economic Resources
F Recreation
G Land Use
H Water Use
I Resource Atlas
J Resource Evaluation

SECTION H - WATER USE

1.0 OBJECTIVES

1. To identify water use in the vicinity of Keenleyside dam.

2. To discuss potential impacts to water systems during construction of the project.

2.0 METHODOLOGY

(a) Inventory

Identify water systems and licences in Lower Arrow Lake near Keenleyside dam and in the Columbia River between Keenleyside and the proposed Murphy Creek dam. Specify the water intake location and type.

(b) Assessment

1. Determine (from B.C. Hydro) the proposed construction locations and techniques for the Keenleyside generation project.

2. Assess potential turbidity levels resulting from construction.

3. Assess potential impacts of turbidity on known water systems.

4. Identify other water quality parameters, if any, which could cause impacts on water systems in the vicinity.

5. Identify possible mitigation measures to reduce impacts to water systems in the vicinity.

KEENLEYSIDE POWERPLANT PROJECT
ENVIRONMENTAL IMPACT EVALUATION
WATER USE STUDY

APPENDIX 2: REFERENCES

OCTOBER 1982
REVISED JANUARY 1984

NO.	REFERENCES

1. B. C. Hydro - Hydroelectric Generation Projects Division

   "Keenleyside Powerplant Project - Engineering Description", November 1982.

2. Kerr Wood Leidal Associates Ltd. - City of Castlegar

   "Phase I Study, Impact of the Murphy Creek Hydro-electric Dam on Municipal Services in the Castlegar Region", February 1981.

3. Dayton & Knight Ltd. - B. C. Hydro and Power Authority

   "Murphy Creek Project Phase II Municipal Studies", January 1982.

4. Kerr Wood Leidal Associates Ltd. - B. C. Hydro

   "Murphy Creek Hydro-electric Project Environmental Impact Evaluation Downstream Water Use Study", October 1981.

5. Regional District of Central Kootenay Planning Department

   "Examination of Water Quality and Water Availability in the Arrow Lakes Region", September 1979.

6. Kerr Wood Leidal Associates Ltd. - City of Castlegar

   "Report on New Water Supply from the Columbia River System", June 1977.

KEENLEYSIDE POWERPLANT PROJECT
ENVIRONMENTAL IMPACT EVALUATION
WATER USE STUDY

APPENDIX 3: COPY OF POLLUTION CONTROL BRANCH PERMIT FOR SELKIRK COLLEGE SEWAGE TREATMENT PLANT

APRIL 1983

DIRECTOR POLLUTION CONTROL BRANCH
WATER RESOURCES SERVICE
PARLIAMENT BUILDINGS
VICTORIA, BRITISH COLUMBIA

PROVINCE OF BRITISH COLUMBIA

COPY

OUR FILE No. 02621(141

YOUR FILE No.

TELEPHONE 386-24

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH
VICTORIA, BRITISH COLUMBIA

October 11, 1972

POLLUTION CONTROL RECEIVED OCT 16 1972 KOOTENAY DISTRICT

REGISTERED

Selkirk College,
Box 1200,
Castlegar, British Columbia.

Gentlemen:

LETTER OF TRANSMITTAL

Enclosed herewith is a copy of an Amendment to Pollution Control Permit No. PE-141 in the name of Selkirk College. Your attention is respectfully directed to the conditions now outlined in the Permit.

In conjunction with this Amendment you are directed to comply with the following requirements:-

A. CHLORINATION

Maintain a chlorine residual between 0.1 and 1.0 ppm at all times and provide not less than one hour's chlorine contact time at average flow rates.

B. MONITORING

1. Sampling

Install a suitable effluent sampling facility and obtain a composite sample of the discharge quarterly. The sample is to consist of 4 consecutive grab samples taken at one-hour intervals and mixed to form a single sample for subsequent analysis.

Proper care should be taken in sampling, storing and transporting to adequately control temperature, contamination, breakage, etc.

2. Analysis

Obtain analyses of the samples for:-

COPY

a) 5 day B.O.D.

b) Suspended Solids

c) Fecal coliform bacteria

Analyses are to be carried out in accordance with the procedures laid out in the most recent edition of "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, or as otherwise approved.

3. Flow Measurement

Install a suitable flow measuring device and record daily the 24 hour discharge.

4. Reporting

Submit tabulated data of analyses and flow measurements annually for the previous year's monitoring. The need for subsequent increased or decreased monitoring will be based on this data.

C. UPGRADING PROGRAMME

Submit a programme before December 31, 1972 showing how it is proposed to upgrade the treatment plant, including the pre-treatment of laboratory waste.

D. PLANS

Submit plans required pursuant to Section (h) 3) of the Permit in duplicate, to the District Manager's office.

A regular monitoring programme of the receiving environment will be implemented by the Branch in connection with this discharge. You will be advised of the details in due course.

Once a Permit has been issued and any appeal time has elapsed, Branch policy provides that the administration of the Permit is carried out by our District Manager who acts under these circumstances for the Director. Therefore all required information respecting this Permit may be submitted to the District Manager in lieu of the Director.

Compliance with the terms and conditions of this Permit will be determined through periodic inspections and monitoring. The location of this discharge falls within the bounds of our Kootenay District under the management of Mr. L.N. Adamache, P. Eng., whose offices are located at 1617 Baker Street, Cranbrook, British Columbia (Telephone 426-5835)

This Permit does not authorize entry on or crossing over, or use for

any purpose, of private or Crown lands unless and except as authorized by the owner of such lands.

The terms and conditions of this Permit may be amended to meet objectives or guidelines as established by the forthcoming Public Inquiry into Municipal Type Waste Discharges.

For your reference, enclosed is a copy of the Pollution Control Act, 1967 as amended.

Yours very truly,

A.J. Chmelauskas, P. Eng.
Assistant Director (Tech.)
Pollution Control Branch

Encl.

COPY

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

AMENDMENT TO PERMIT

Pursuant to Section 6 of the *Pollution Control Act, 1967*

Permit No. PE-141 Dated October 7, 1965 in favour of

West Kootenay Regional College
(Name)

of 1186 Cedar Avenue, Trail, B.C.
(Address)

is hereby amended as follows:

Delete the legal name of the Permittee which reads:-

"West Kootenay Regional College"

and substitute in its place the following:-

"Selkirk College"

Delete the legal address of the Permittee which reads:-

"1186 Cedar Avenue, Trail, B.C."

and substitute in its place the following:-

"Box 1200, Castlegar, British Columbia"

Delete that portion of Section (d) of the Permit which reads:-

"Suspended Solids 110 ppm (Avg. 60); BOD 100 ppm (Avg. 50); avg. coliform bacteria mpn 5,000 per 100 ml (max. month 50,000)"

and substitute in its place the following:-

"Suspended Solids 110 mg/l, BOD 100 mg/l until December 31, 1973 and Suspended Solids 60 mg/l, BOD 45 mg/l thereafter"

Delete that portion of Section (f) of the Permit which reads:-

"the peninsula located south of the Kootenay River at the confluence of the Columbia and Kootenay rivers, encompassing approximately Lot 10, Blocks 1, 2, 3, 4, 14, 15, 16, 17"

and substitute in its place the following:-

"Lot 10, Block 1, Sublot 5"

Delete that portion of Section (m) of the Permit which reads:-

"until May 31, 1970"

and substitute in its place the following:-

"99 years"

(Contd.)

This Amendment, or any of the conditions contained therein, may be amended, varied, or rescinded by order, or otherwise.

Date issued October 11, 1972

Assistant Director of Pollution Control

COPY

Delete that portion of Section (h) 3) of the Permit which reads:-

"Final plans of the treatment system and outfall approved under the Health Act and a plan showing the legal boundaries and description of the college property showing exact location of the outfall shall be submitted to the Executive Engineer for record."

and substitute in its place the following:-

"The authority to discharge is contingent upon the works having been constructed as per final construction plans approved in accordance with the Pollution Control Act, 1967"

Date issued October 11, 1972

Assistant Director of Pollution Control

COPY

POLLUTION-CONTROL BOARD
(Chapter 36 of Statutes of 1956)

PERMIT

West Kootenay Regional College (Name.), of 1186 Cedar Avenue, Trail, B.C. (Address.)
is hereby authorized to discharge effluent as follows:—

(*a*) The source of the effluent is domestic wastes from the college. (Plant, factory, municipality, etc.)

(*b*) The point of discharge is located as shown on the attached plan.

(*c*) The maximum quantity of effluent which may be discharged is 82 gpm; avg. 30,000 gpd.

(*d*) The quality of the effluent shall be at all times equivalent to or better than Suspended Solids 110 ppm (avg. 60); BOD 100 ppm (avg. 50); avg. coliform bacteria mpn 5,000 (Per cent solids, toxicity, B.O.D., etc.) per 100 ml (max. month 50,000).

(*e*) The works authorized to be constructed are extended aeration package treatment plant with chlorination and outfall to Columbia River, located as shown on the attached plan.

(*f*) The land from which the effluent originates and to which this permit is appurtenant is the peninsula located south of the Kootenay River at the confluence of the Columbia and Kootenay rivers, encompassing approximately Lot 10, Blocks 1,2,3,4,14,15,16,17.

(*g*) The period of time for which this permit is valid is until May 31, 1970.

(*h*) The Board directs that the following special conditions shall apply

1) The plant shall receive daily maintenance and a daily chlorine residual record shall be kept and be available for inspection at the plant.

2) No garbage grinders shall be permitted on the system.

3) Final plans of the treatment system and outfall approved under the Health Act and a plan showing the legal boundaries and description of the college property showing exact location of the outfall shall be submitted to the Executive Engineer for record.

Chairman, Pollution-control Board.

Date issued October 7, 1965

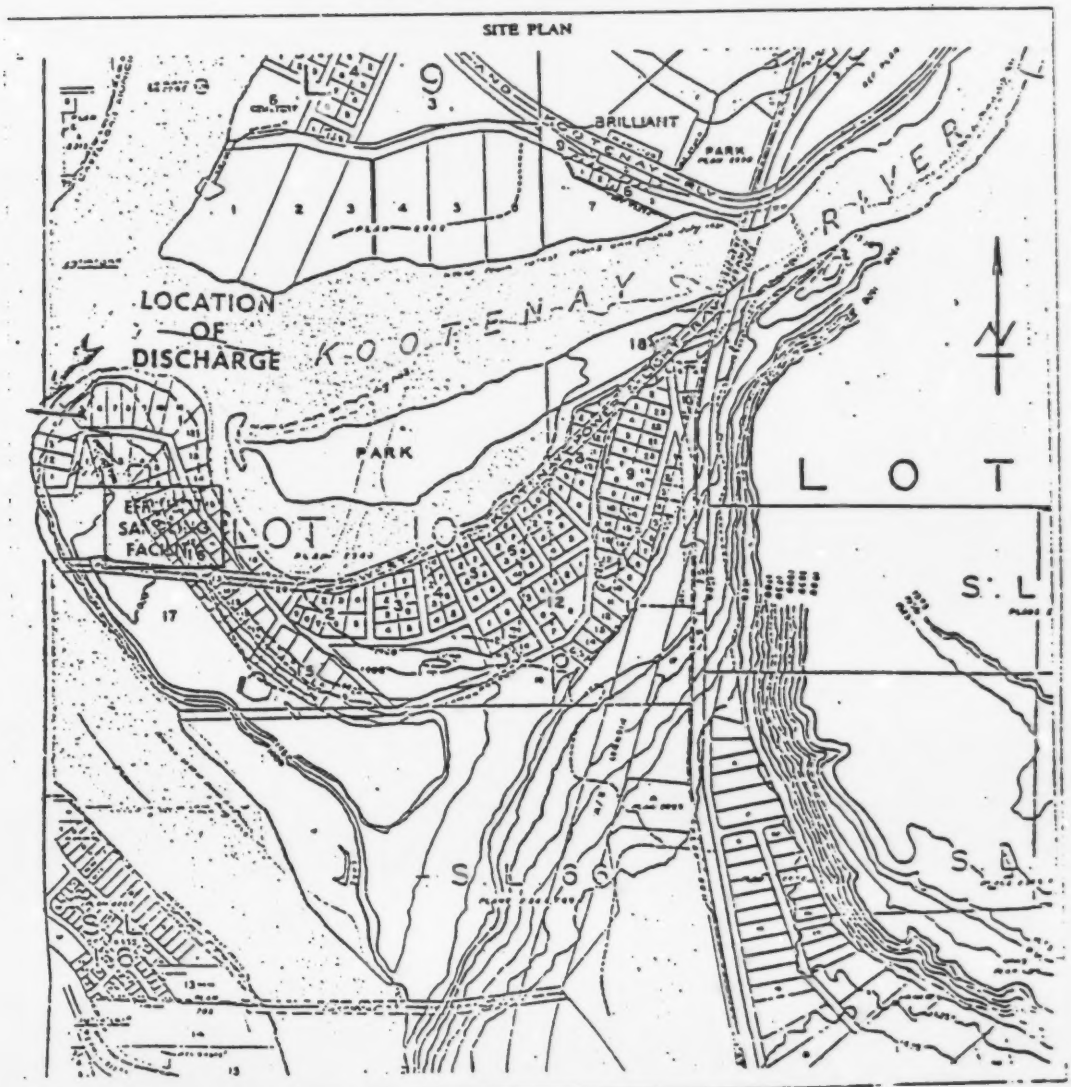
Permit No. 141

500-257-6751

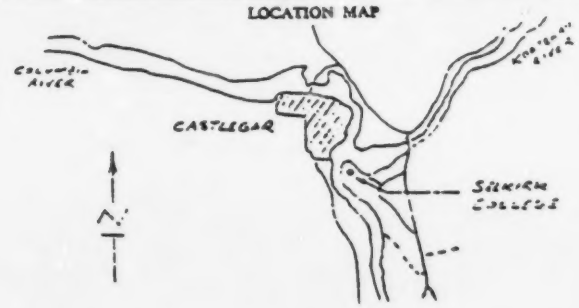
COPY

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

SITE PLAN



LOCATION MAP



(Name of applicant(s))

(Date) (Signature of applicant(s) or agent)

(FOR OFFICE USE ONLY)

Oct. 31, 1973
(Date issued) Approved (Name of Pollution Control Branch)

Appendix A to Permit No PE-141

KEENLEYSIDE POWERPLANT PROJECT
ENVIRONMENTAL IMPACT EVALUATION
WATER USE STUDY

APPENDIX 4: COPY OF POLLUTION CONTROL BRANCH PERMIT FOR NORTH CASTLEGAR SEWAGE TREATMENT PLANT

OCTOBER 1982
REVISED JANUARY 1984

ADDRESS ALL COMMUNICATIONS TO:
DIRECTOR, POLLUTION CONTROL BRANCH
PARLIAMENT BUILDINGS
VICTORIA, BRITISH COLUMBIA

COPY

Our File No. 0262100-

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH
VICTORIA, BRITISH COLUMBIA

January 13, 1975

POLLUTION CONTROL BRANCH
JAN 22 1975
NELSON, B.C.

DOUBLE REGISTERED

City of Castlegar
460 Columbia Avenue
Castlegar, British Columbia

Gentlemen:

LETTER OF TRANSMITTAL

Enclosed herewith is a copy of Pollution Control Permit No. PE-80 in the name of City of Castlegar incorporating an Amendment dated January 13, 1975. The terms and conditions of this amended Permit replace and supersede those of Permit No. PE-80 as issued on December 9, 1963 and amended July 21, 1969 and May 24, 1973 as of and from the date of this latest Amendment.

Your attention is respectfully directed to the conditions now outlined in the Permit.

In conjunction with this amended Permit, the requirements in the Letter of Transmittal to the Town of Castlegar dated May 24, 1973 still apply and a copy is enclosed for your reference.

Yours very truly,

W. H. Venables, P.Eng.
Director
Pollution Control Branch

Encl.

PCB 11—0

COPY

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

PERMIT

Under the Provisions of the Pollution Control Act, 1967

City of Castlegar

460 Columbia Avenue, Castlegar, British Columbia

is hereby authorized to discharge effluent

from a municipal sewerage system

located at Castlegar

to the Columbia River

This permit has been issued under the terms and conditions prescribed in the attached appendices

01 and A

Director, Pollution Control Branch

Date issued December 9, 1963

Amendments dated July 21, 1969

May 24, 1973

January 13, 1975

Permit No. PE-80

PCB 11—0

COPY

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

APPENDIX No. 01

to Pollution Control Permit No. PE-80

(a) The discharge of effluent applicable to this appendix is from a municipal sewerage system
(Source of operation)
as shown on attached Appendix A

(b) The quantity of effluent which may be discharged is a maximum of 600,000 Imperial Gallons per day.

(c) The characteristics of the effluent shall be equivalent to or better than
5-day Biochemical Oxygen Demand 45 mg/l
Total Suspended Solids 60 mg/l

(d) The works authorized are mechanically aerated stabilization ponds followed by polishing lagoons, chlorination facilities, outfall and related appurtenances
approximately as shown on the attached Appendix A

(e) The land from which the effluent originates and to which this appendix is appurtenant is Parcel B (DD 12274 - I) of Lot 237 Kootenay District, Nelson-Slocan Assessment District.

(f) Those works authorized and proposed must be completed and in operation on or before December 31, 1975.

(g) The authority to discharge is contingent upon the authorized works having been constructed as per final ~~xxxxxxxxx~~ plans approved in accordance with the *Pollution Control Act, 1967*.

Date issued December 9, 19 67.
Date amended July 21, 19 69
May 26, 19 73
January 13, 1975

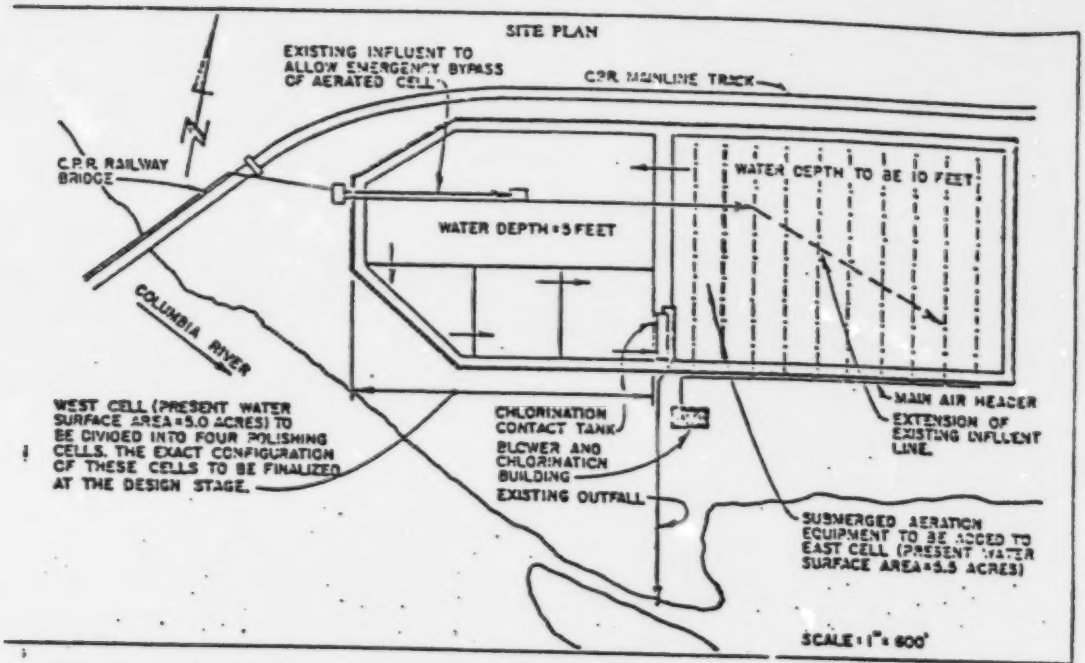
Director, Pollution Control Branch

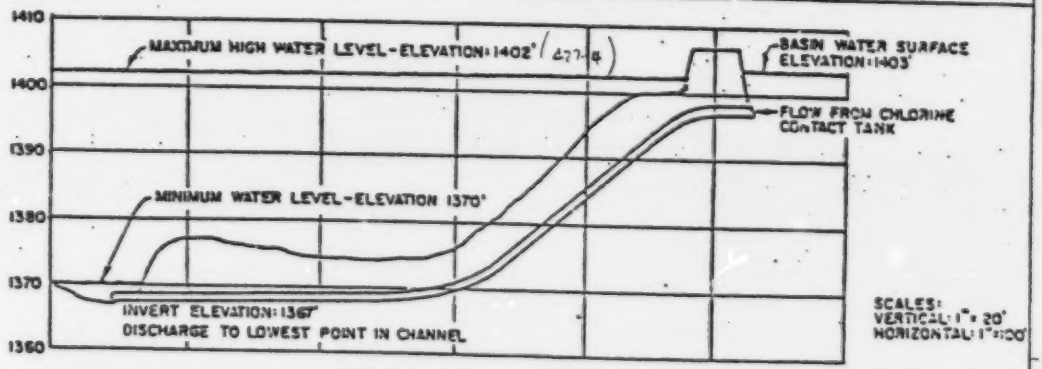
PCB 13—0

COPY

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE

POLLUTION CONTROL BRANCH

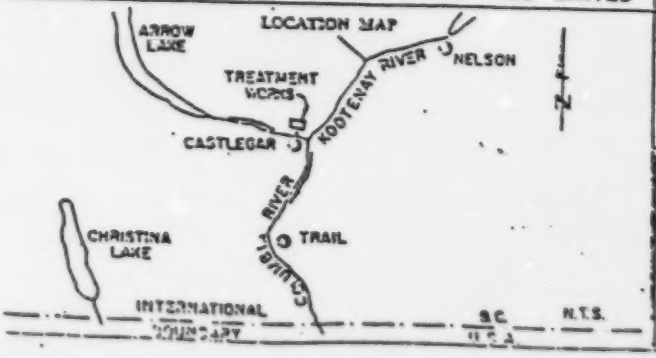

SITE PLAN
EXISTING INFLUENT TO ALLOW EMERGENCY BYPASS OF AERATED CELL
C.P.R. MAINLINE TRACK
C.P.R. RAILWAY BRIDGE
WATER DEPTH TO BE 10 FEET
WATER DEPTH = 5 FEET
COLUMBIA RIVER
WEST CELL (PRESENT WATER SURFACE AREA = 5.0 ACRES) TO BE DIVIDED INTO FOUR POLISHING CELLS. THE EXACT CONFIGURATION OF THESE CELLS TO BE FINALIZED AT THE DESIGN STAGE.
CHLORINATION CONTACT TANK
BLOWER AND CHLORINATION BUILDING
EXISTING OUTFALL
MAIN AIR HEADER
EXTENSION OF EXISTING INFLUENT LINE
SUBMERGED AERATION EQUIPMENT TO BE ADDED TO EAST CELL (PRESENT WATER SURFACE AREA = 5.5 ACRES)
SCALE: 1" = 600'



PROFILE OF OUTFALL

PREPARED BY: ASSOCIATED ENGINEERING SERVICES LIMITED

DRAWING: 4006-905-PC3-1



TOWN OF CASTLEGAR
(Name of Applicant(s))

JAN 8, 1973 (Date) — (Signature of Applicant(s) or Agent)

(FOR OFFICE USE ONLY)

January 13, 1975

May 26, 1973 (Date Issued) — (Director, Pollution Control Branch)

Appendix A to Permit No. PE-30

KEENLEYSIDE POWERPLANT PROJECT
ENVIRONMENTAL IMPACT EVALUATION
WATER USE STUDY

APPENDIX 5: COPY OF POLLUTION CONTROL BRANCH PERMIT FOR SOUTH CASTLEGAR SEWAGE TREATMENT PLANT

OCTOBER 1982
REVISED JANUARY 1984

ADDRESS ALL COMMUNICATIONS TO:
DIRECTOR, POLLUTION CONTROL BRANCH
PARLIAMENT BUILDINGS
VICTORIA, BRITISH COLUMBIA
V8V 4R8

COPY

WHEN REPLYING PLEASE QUOTE:
OUR FILE No. 0202100-PE-
YOUR FILE No.
TELEPHONE 387-5281

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH
VICTORIA, BRITISH COLUMBIA

POLLUTION CONTROL BRANCH
MAY 23 1975
NELSON, B.C.

May 16, 1975

DOUBLE REGISTERED

The Corporation of the City of Castlegar
460 Columbia Avenue
Castlegar, British Columbia
V1N 1G7

Gentlemen:

LETTER OF TRANSMITTAL

Enclosed is a copy of Pollution Control Permit No. PE-1008 in the name of The Corporation of the City of Castlegar. Your attention is respectfully directed to the conditions outlined in the Permit.

In conjunction with this Permit, you are directed to comply with the following conditions:

A. CHLORINATION

Maintain a chlorine residual in the effluent between 0.1 and 1.0 ppm at all times and provide not less than one hour chlorine contact time at average flow rates.

B. MONITORING

1. Sampling

Install a suitable effluent sampling facility and obtain a composite sample of the discharge once every month. The sample is to consist of four consecutive grab samples taken at one hour intervals and mixed.

Proper care should be taken in sampling and in storing and transporting samples, to adequately control temperature and avoid contamination, breakage, etc.

2. Analysis

Obtain analyses of the sample for:

...2

COPY

(a) Total Suspended Solids

(b) 5-day Biochemical Oxygen Demand

Analyses are to be carried out in accordance with procedures described in the first edition (January, 1973) of "A Laboratory Manual for the Chemical Analysis of Waters, Wastewaters and Biological Tissues", or suitable alternative procedures as approved by the Director.

Copies of the above mentioned manual are available from the Environmental Laboratory of the Water Resources Service, 3650 Wesbrook Crescent, Vancouver, British Columbia, V6S 2L2, at a cost of $7.00, and are also available for inspection at all Pollution Control Branch offices.

3. Flow Measurement

Install a suitable flow measuring device and record the daily discharge.

4. Reporting

Maintain data of analyses and flow measurements for inspection and semi-annually submit the data suitably tabulated, for the previous six months' monitoring. The first report is to be submitted six months after discharge commences. The need for subsequent increased or decreased monitoring will be assessed on the basis of the monitoring data submitted and any other data gathered by the Pollution Control Branch in connection with this discharge.

C. PLANS

Plans and specifications of the proposed works authorized shall be submitted to the Director in duplicate and approval obtained. It should be noted that section (g) of Permit Appendix 01 requires construction being in accordance with plans approved.

D. OUTFALL

Construct an outfall which discharges the effluent to the mainstream of the river to obtain good initial mixing and to minimize diluted effluent being directed shoreward. The point of discharge shall be to the satisfaction of our Regional Manager.

The terms and conditions of this Permit may be amended to meet any objectives or guidelines which may be established as a result of the Public Inquiry into Municipal Type Waste Discharges and the Environmental Study of the Kootenay Region, monitoring results or any other information rele-

...3

COPY

(a) Total Suspended Solids

(b) 5-day Biochemical Oxygen Demand

Analyses are to be carried out in accordance with procedures described in the first edition (January, 1973) of "A Laboratory Manual for the Chemical Analysis of Waters, Wastewaters and Biological Tissues", or suitable alternative procedures as approved by the Director.

Copies of the above mentioned manual are available from the Environmental Laboratory of the Water Resources Service, 3650 Wesbrook Crescent, Vancouver, British Columbia, V6S 2L2, at a cost of $7.00, and are also available for inspection at all Pollution Control Branch offices.

3. Flow Measurement

Install a suitable flow measuring device and record the daily discharge.

4. Reporting

Maintain data of analyses and flow measurements for inspection and semi-annually submit the data suitably tabulated, for the previous six months' monitoring. The first report is to be submitted six months after discharge commences. The need for subsequent increased or decreased monitoring will be assessed on the basis of the monitoring data submitted and any other data gathered by the Pollution Control Branch in connection with this discharge.

C. PLANS

Plans and specifications of the proposed works authorized shall be submitted to the Director in duplicate and approval obtained. It should be noted that section (g) of Permit Appendix 01 requires construction being in accordance with plans approved.

D. OUTFALL

Construct an outfall which discharges the effluent to the mainstream of the river to obtain good initial mixing and to minimize diluted effluent being directed shoreward. The point of discharge shall be to the satisfaction of our Regional Manager.

The terms and conditions of this Permit may be amended to meet any objectives or guidelines which may be established as a result of the Public Inquiry into Municipal Type Waste Discharges and the Environmental Study of the Kootenay Region, monitoring results or any other information rele-

...3

COPY

vant to this discharge.

The administration of this Permit, including periodic inspections and monitoring, will be carried out by staff from our Regional office located at 310 Ward Street, Nelson, British Columbia, V1L 5S4 (telephone 352-2211, local 273). Any required information may be submitted to the Regional Manager at this address in lieu of the Director.

This Permit does not authorize entry upon, crossing over, or use for any purpose, of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall lie with the Permittee.

For your reference, enclosed is a copy of the Pollution Control Act, 1967, as amended, and the Regulations thereto.

Yours very truly,

H. P. Klassen, P. Eng.
Assistant Director (Services)
Pollution Control Branch

Encl.

COPY

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

PERMIT

Under the Provisions of the Pollution Control Act, 1967

The Corporation of the City of Castlegar

460 Columbia Avenue, Castlegar, British Columbia

is hereby authorized to discharge effluent

from a municipal sewerage system

located in the southern part of Castlegar

to the Columbia River

This permit has been issued under the terms and conditions prescribed in the attached appendices

01 and A

Assistant Director, Pollution Control Branch

Date issued May 16, 19 75

Amendments dated ____, 19__

____, 19__

____ 19

Permit No. PE-4008

PCB 11—0

COPY

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

APPENDIX No. 01

to Pollution Control Permit No. PE-4008

(a) The discharge of effluent applicable to this appendix is from a municipal sewerage system
(Source of operation)
as shown on attached Appendix A.

(b) The quantity of effluent which may be discharged is a maximum of 720,000 Imperial gallons per day.

(c) The characteristics of the effluent shall be equivalent to or better than
5-Day Biochemical Oxygen Demand 45 mg/l
Total Suspended Solids 60 mg/l

(d) The works authorized are an activated sludge treatment plant followed by chlorination facilities, sludge lagoons, outfall and related appurtenances
approximately as shown on the attached Appendix A.

(e) The land from which the effluent originates and to which this appendix is appurtenant is a portion of Lot A, Plan 7072, District Lot 4598, Nelson District.

(f) Those works authorized and proposed must be completed and in operation on or before December 31, 1976.

(g) The authority to discharge is contingent upon the authorized works having been constructed as per ~~XXXX~~ plans approved in accordance with the *Pollution Control Act, 1967*.

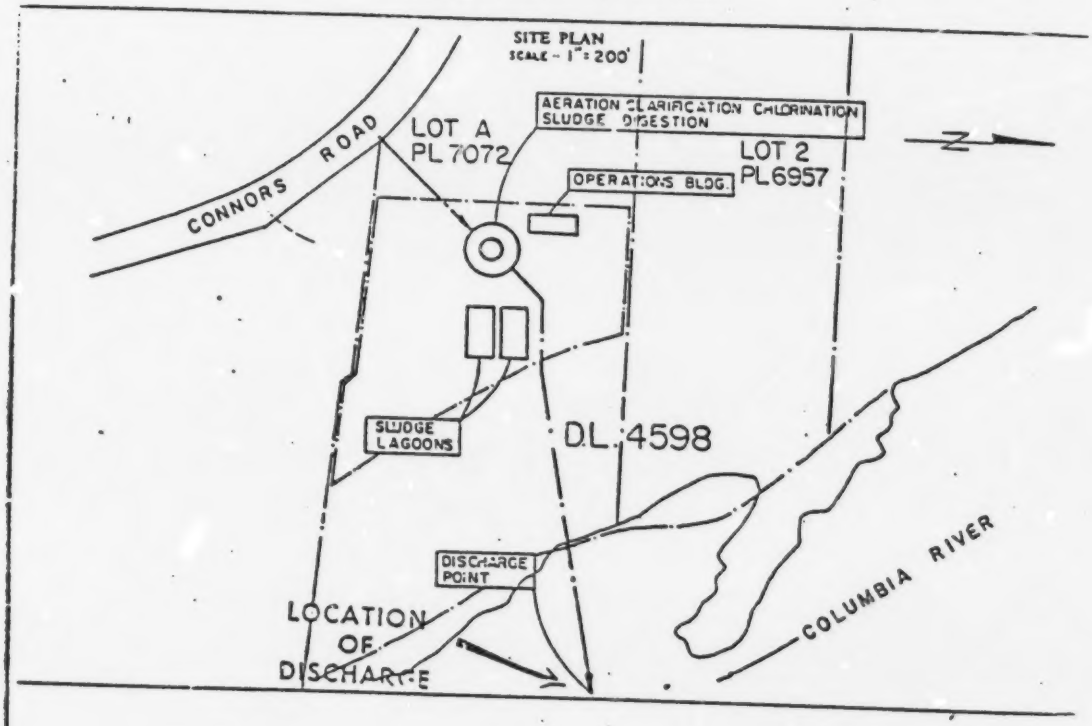
Date issued May 16, 19 75
Date amended ....., 19....
....., 19....

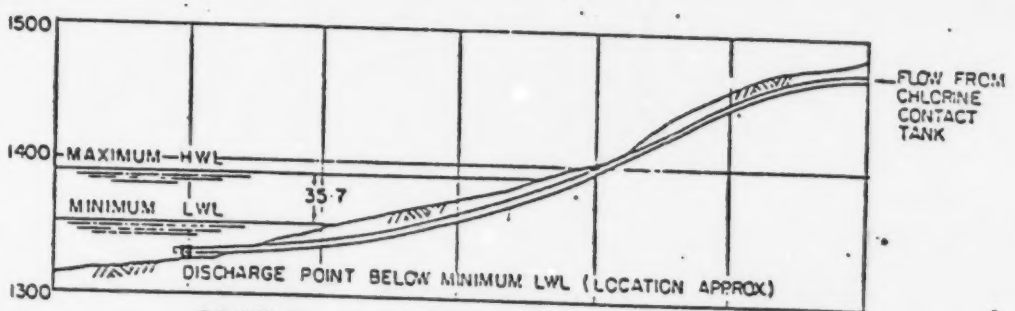
Assistant Director, Pollution Control Branch

PCB 13—0

COPY

DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH





PROFILE OF OUTFALL SCALE 1" = 100'

PREPARED BY: ASSOCIATED ENGINEERING SERVICES LIMITED

DRAWING.

THE CORPORATION OF
THE CITY OF CASTLEGAR
(Name of applicant(s))

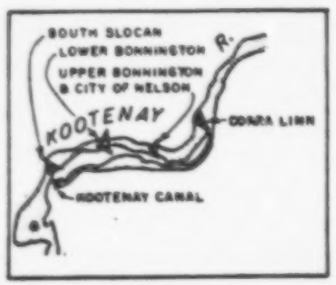
OCT. 18/74
(Date)

(Signature of applicant(s) or agent)

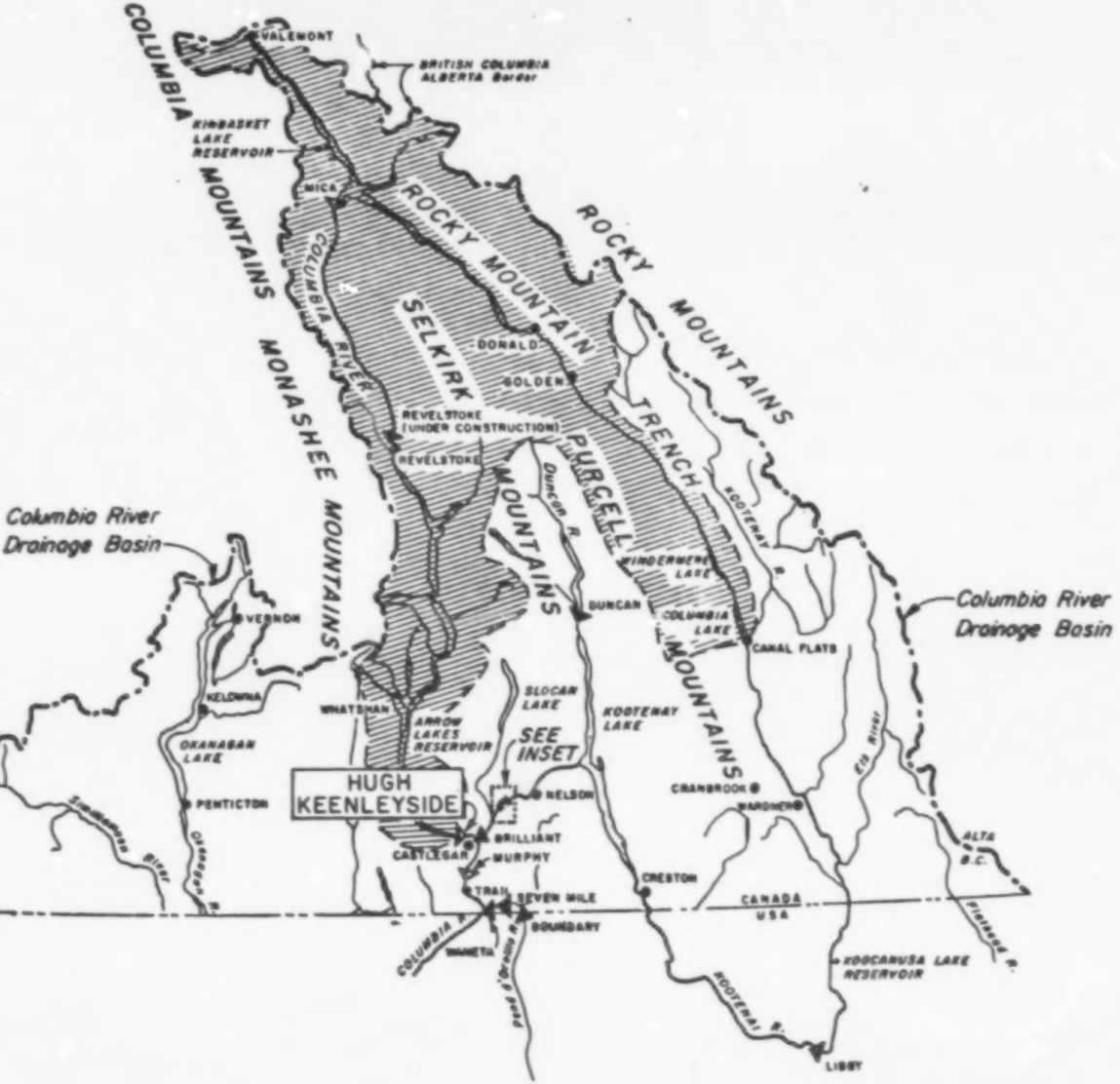
(FOR OFFICE USE ONLY)

May 16, 1975
(Date issued) Assistant (Director, Pollution Control Branch)

Appendix A to Permit No. PE-4208



INSET



SCALE IN KILOMETERS

20 0 20 40 60 80 100

KEY PLAN

LEGEND:

- City, town, or settlement
- Existing dam
- Potential dam
- Limit of Hugh Keenleyside drainage basin

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

KEENLEYSIDE POWERPLANT PROJECT

KEY MAP

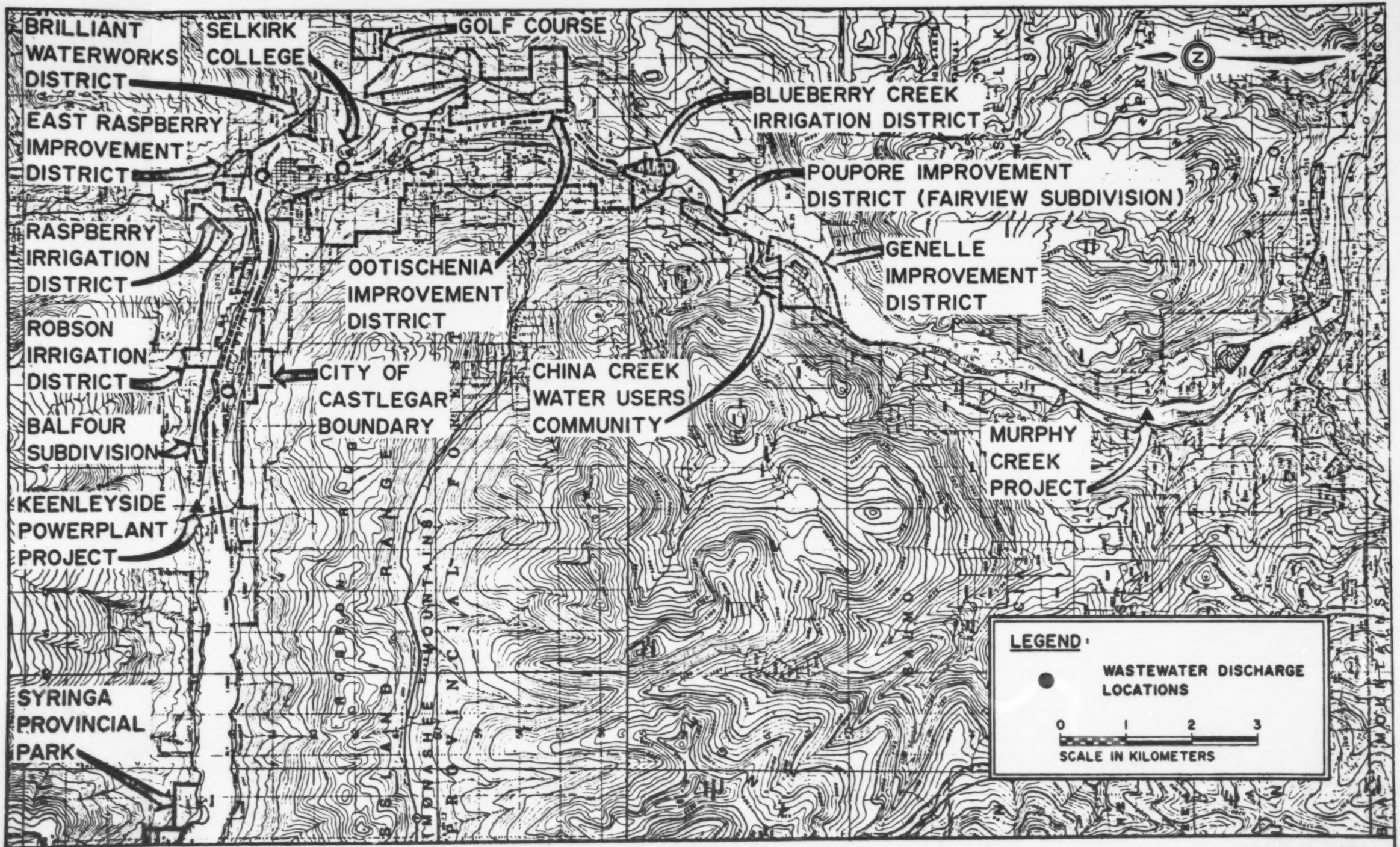
DATE MAR 1982	FIG. 1-1
DWN NO	DWG No 240-C14-B64

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

KEENLEYSIDE POWERPLANT PROJECT

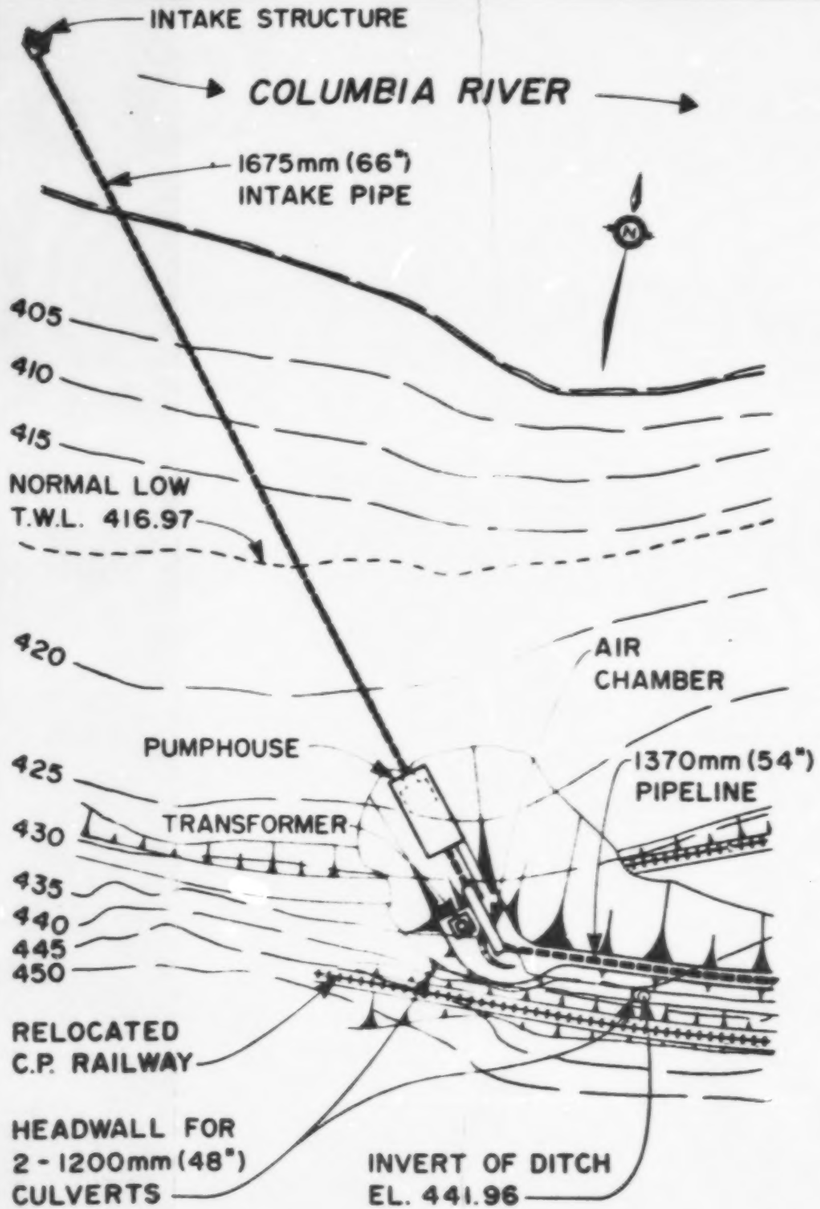
LOCATION MAP

DATE MAR 1962	FIG. 1-2	R
DWG NO.	CODE 240-C14-D65	

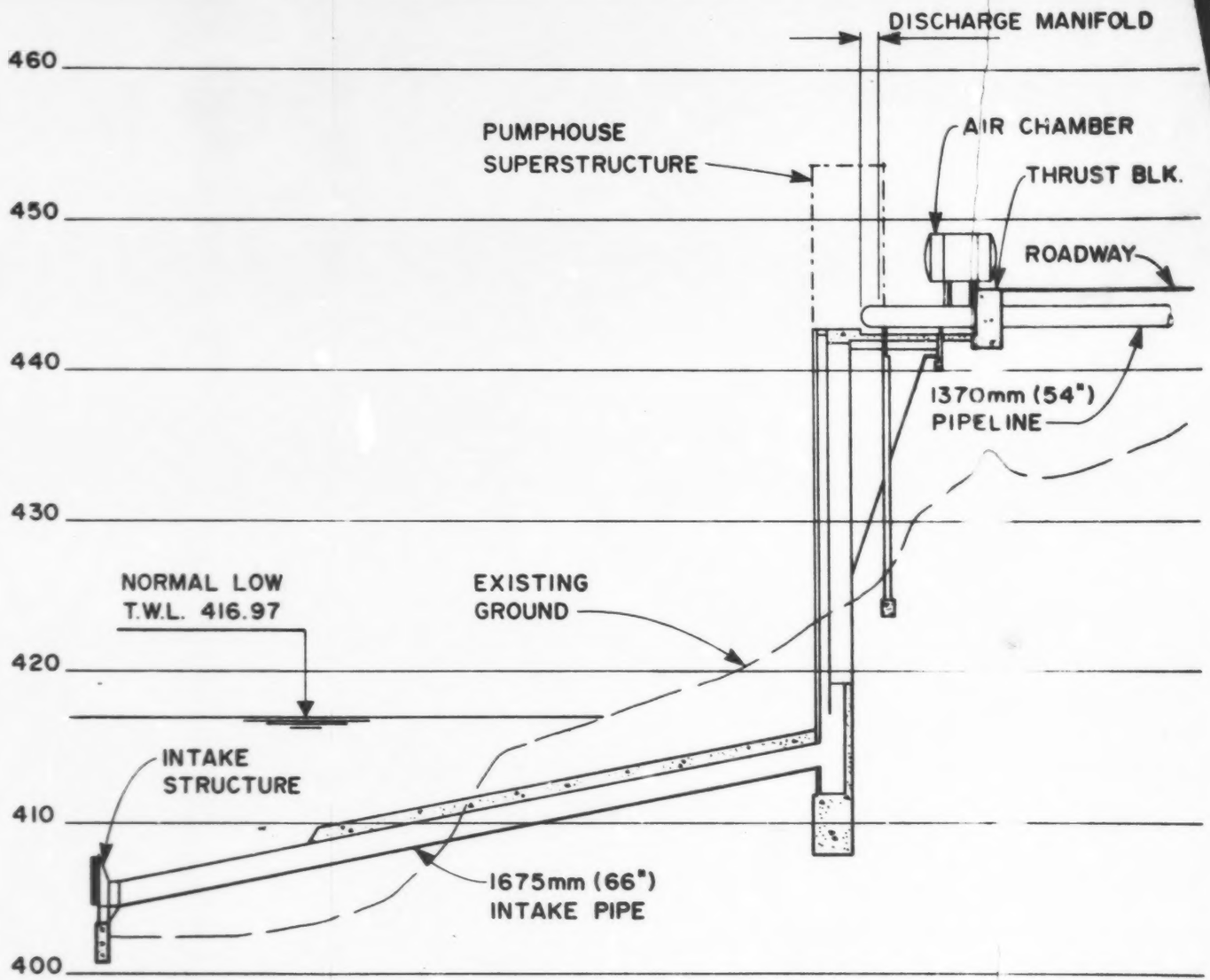


EXISTING WATERWORKS SYSTEMS & WASTEWATER DISCHARGE LOCATIONS

FIGURE 2-1



PLAN



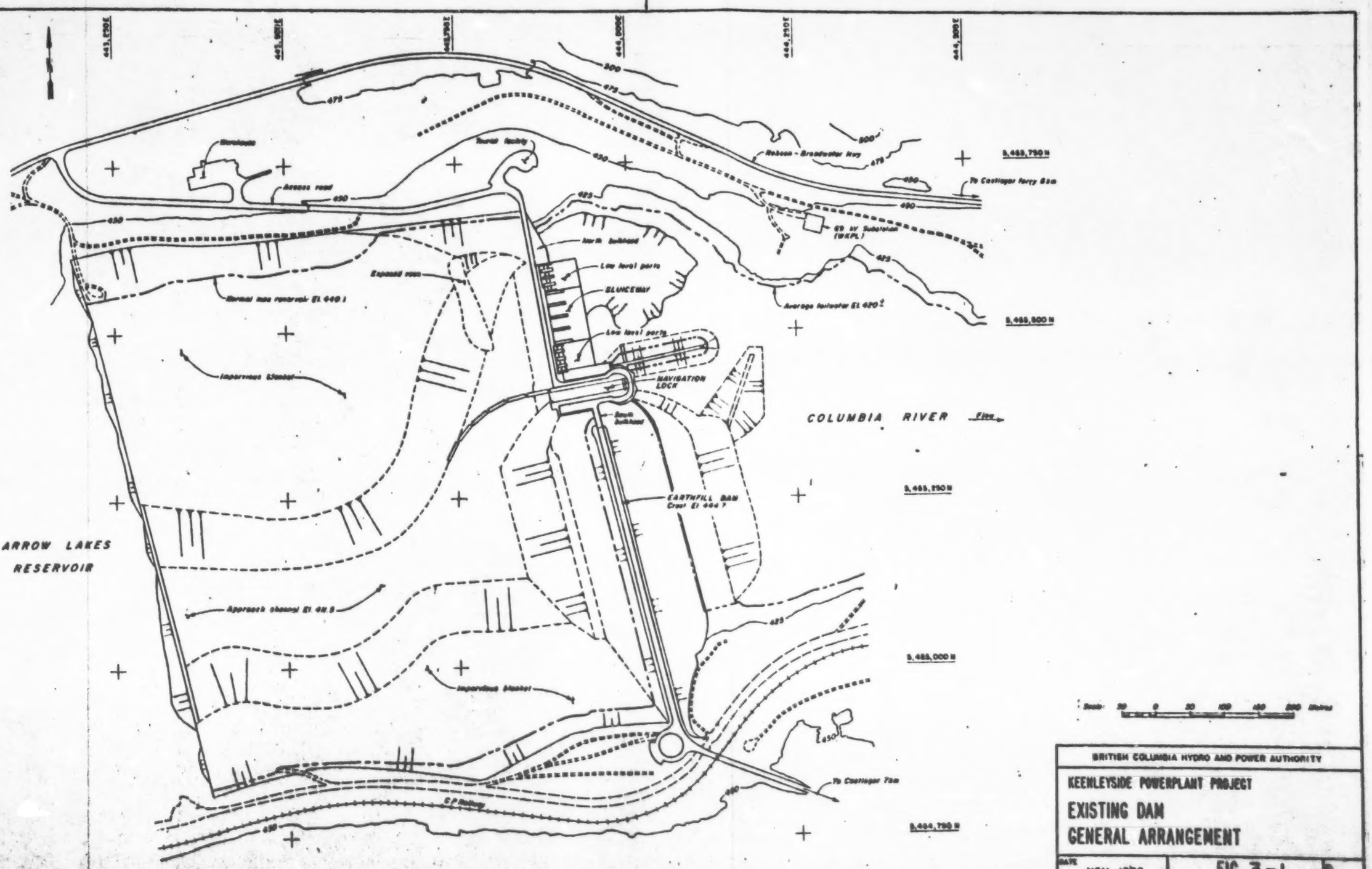
PROFILE

0 5 10

SCALE IN METRES

B.C. TIMBER - CITY OF CASTLEGAR
ARROW LAKES WATER SUPPLY INTAKE

FIGURE 2-2



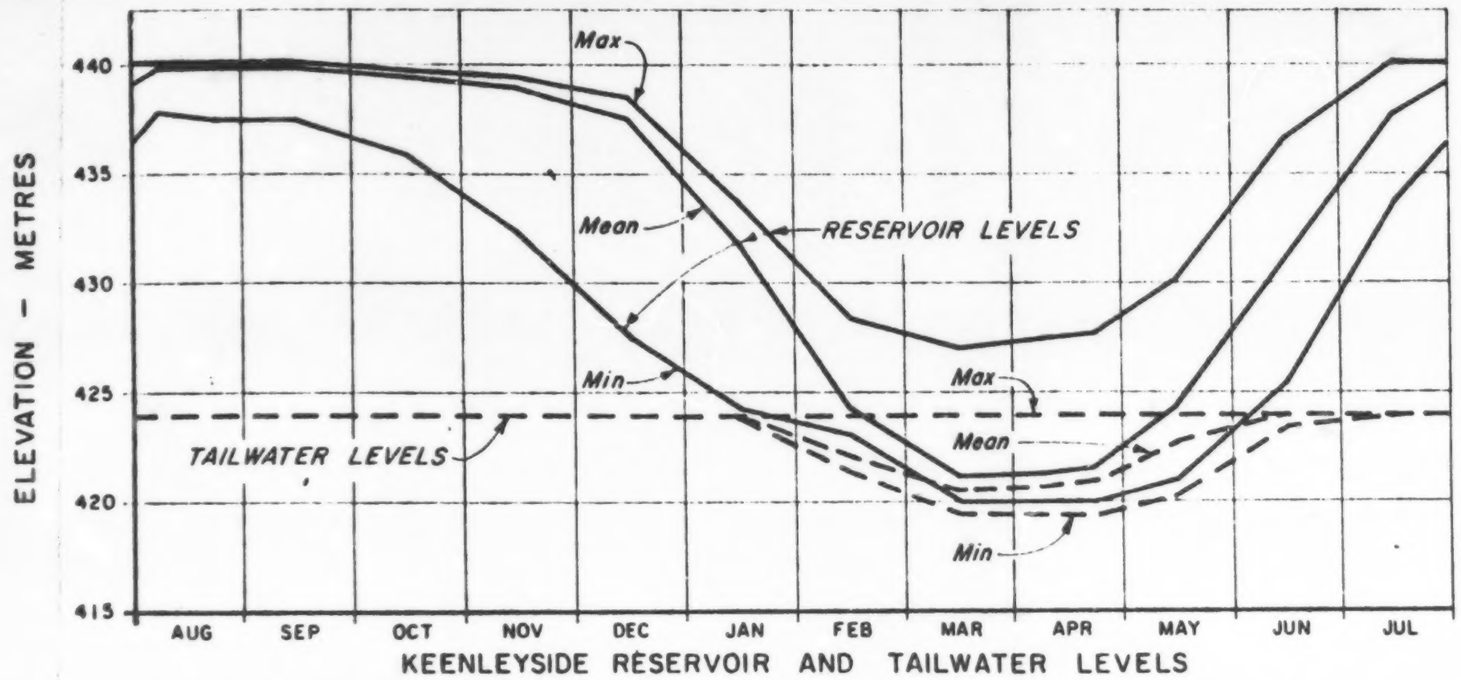
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

KEENLEYSIDE POWERPLANT PROJECT

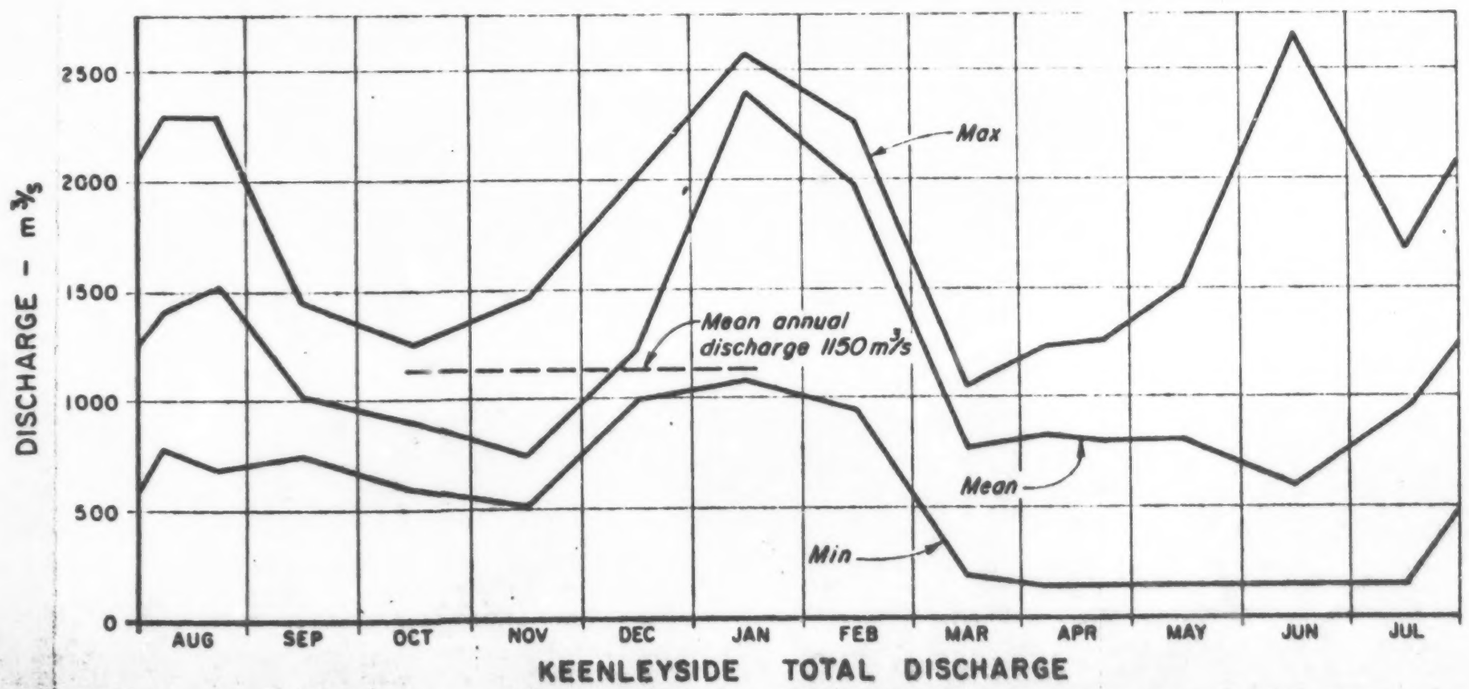
EXISTING DAM
GENERAL ARRANGEMENT

DATE	FIG 3-1	R
NOV. 1982		
DRAWN DJ	DRAWING No. 240-C14-D165	

REPORT No 11082



KEENLEYSIDE RESERVOIR AND TAILWATER LEVELS



KEENLEYSIDE TOTAL DISCHARGE

NOTE:

KEENLEYSIDE TAILWATER LEVELS ARE BASED ON A MURPHY CREEK PROJECT RESERVOIR ELEVATION LIMIT OF 424.0 m AT CASTLEGAR.

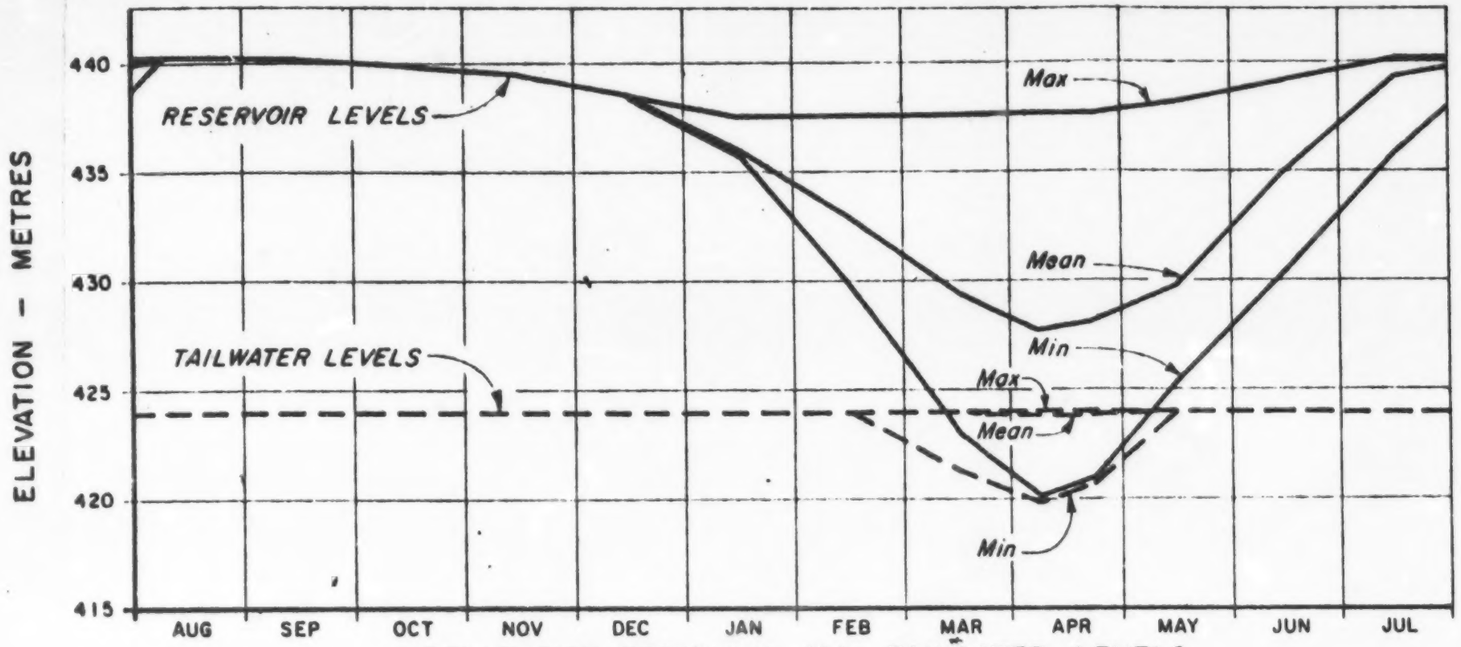
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

KEENLEYSIDE POWERPLANT PROJECT

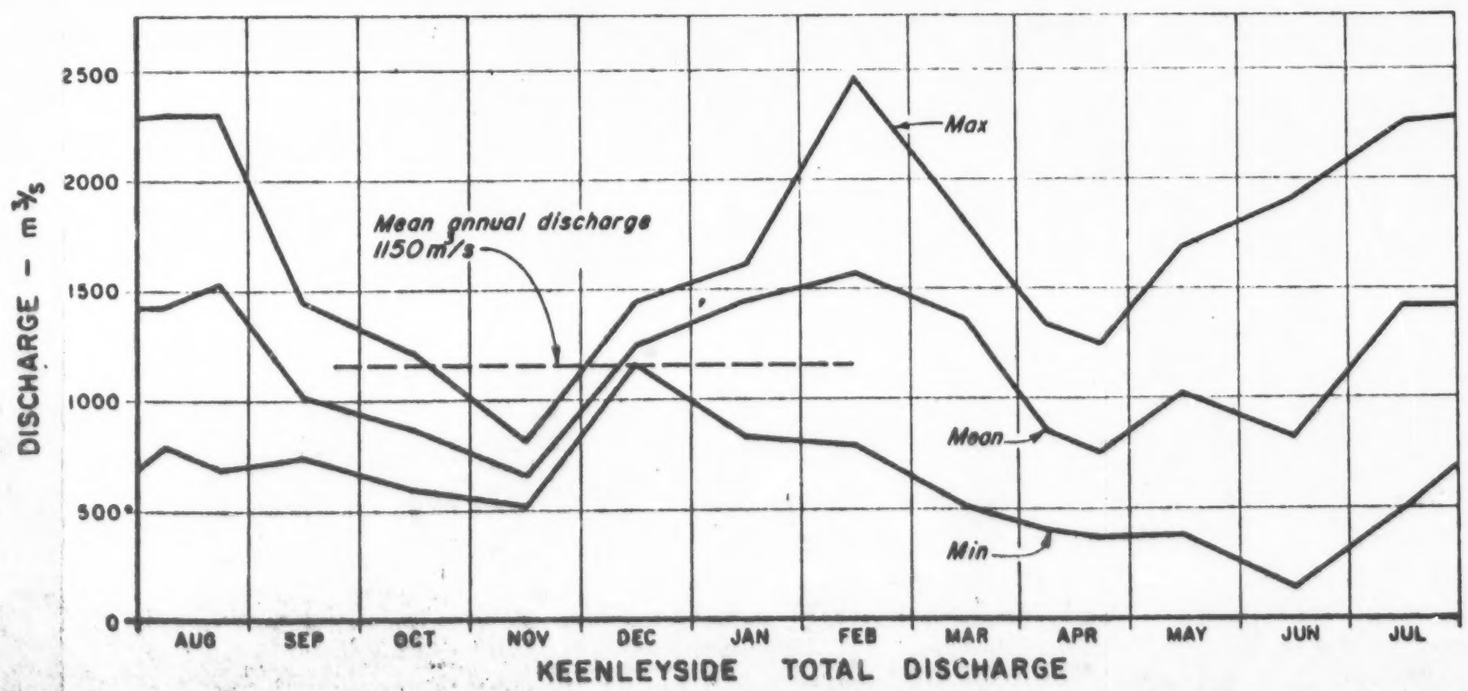
TYPICAL RESERVOIR LEVELS & DISCHARGE HYDROGRAPHS - EXISTING OPERATION (REGIME 1)

DATE NOV. 1982	FIG 3-2
DWN KL	DES. No 240 - C14 - [illegible]

REPORT No. [illegible]



KEENLEYSIDE RESERVOIR AND TAILWATER LEVELS



KEENLEYSIDE TOTAL DISCHARGE

NOTE:

KEENLEYSIDE TAILWATER LEVELS ARE BASED ON A MURPHY CREEK PROJECT RESERVOIR ELEVATION LIMIT OF 424.0 m AT CASTLEGAR.

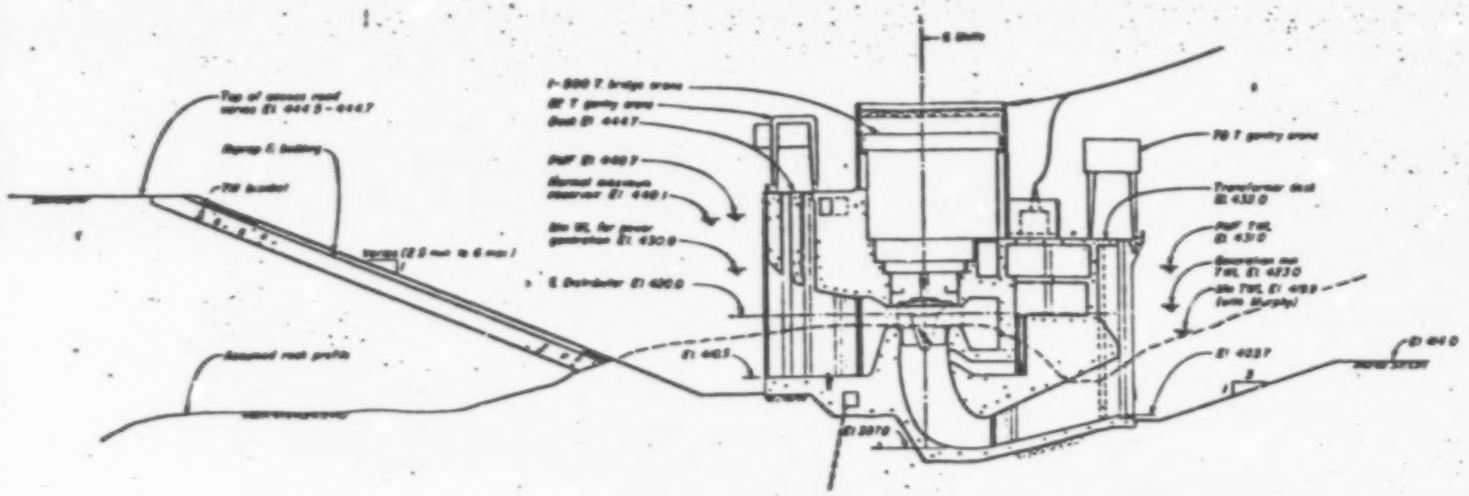
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

KEENLEYSIDE POWERPLANT PROJECT

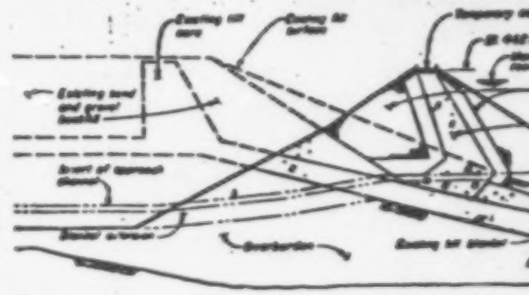
TYPICAL RESERVOIR LEVELS & DISCHARGE HYDROGRAPHS - FUTURE OPERATION (REGIME 2)

DATE NOV. 1982	FIG 3-3
DWN KL	DWG No 240-C14-[illegible]

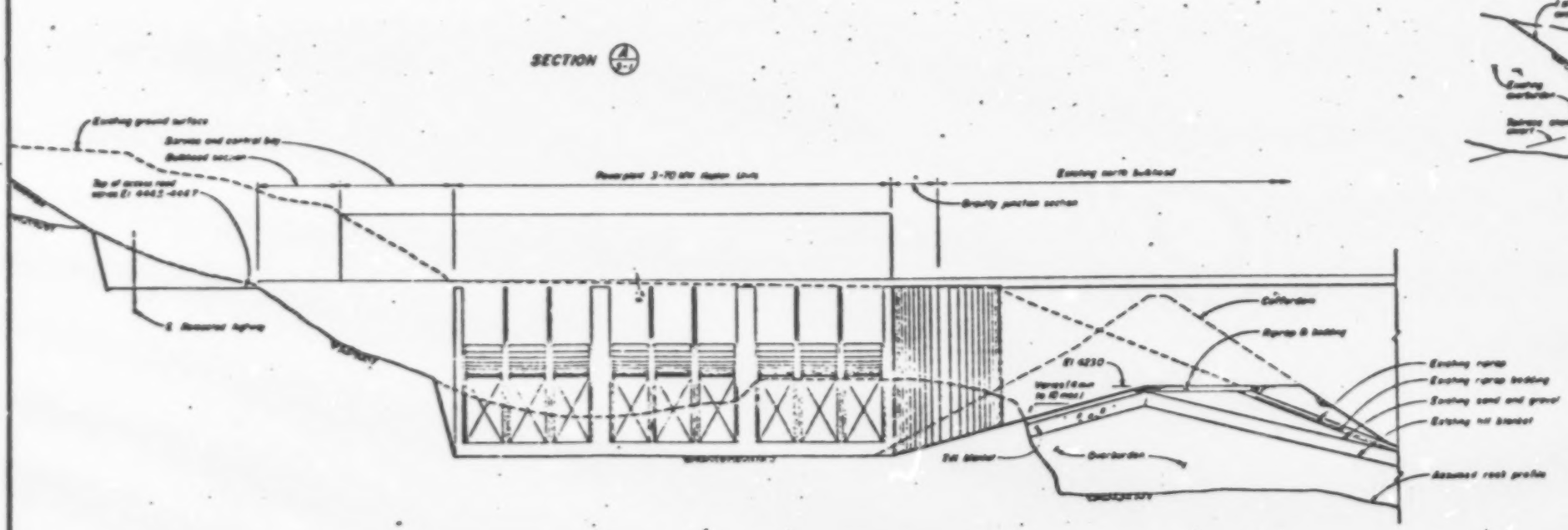
REPORT No [illegible]



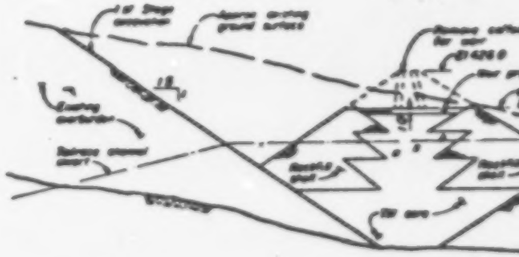
SECTION



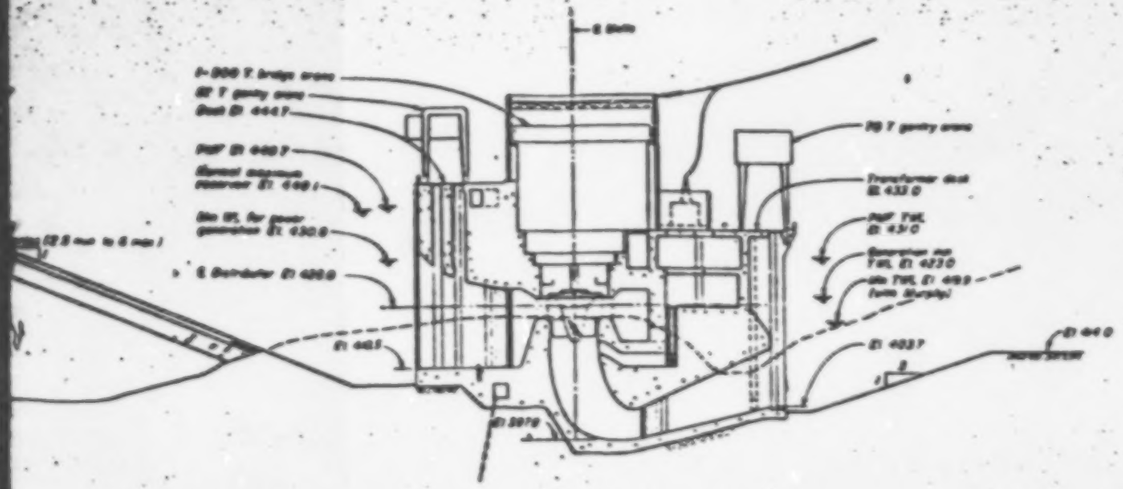
SECTION
UPSTREAM COFFERDAM



SECTION



SECTION
DOWNSTREAM COFFERDAM



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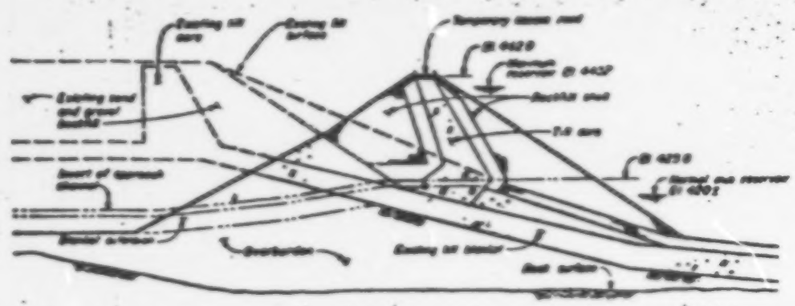
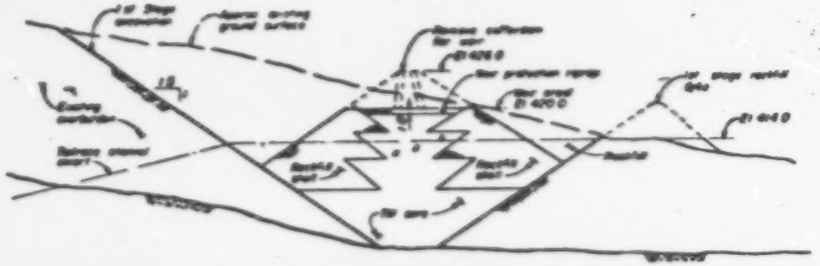
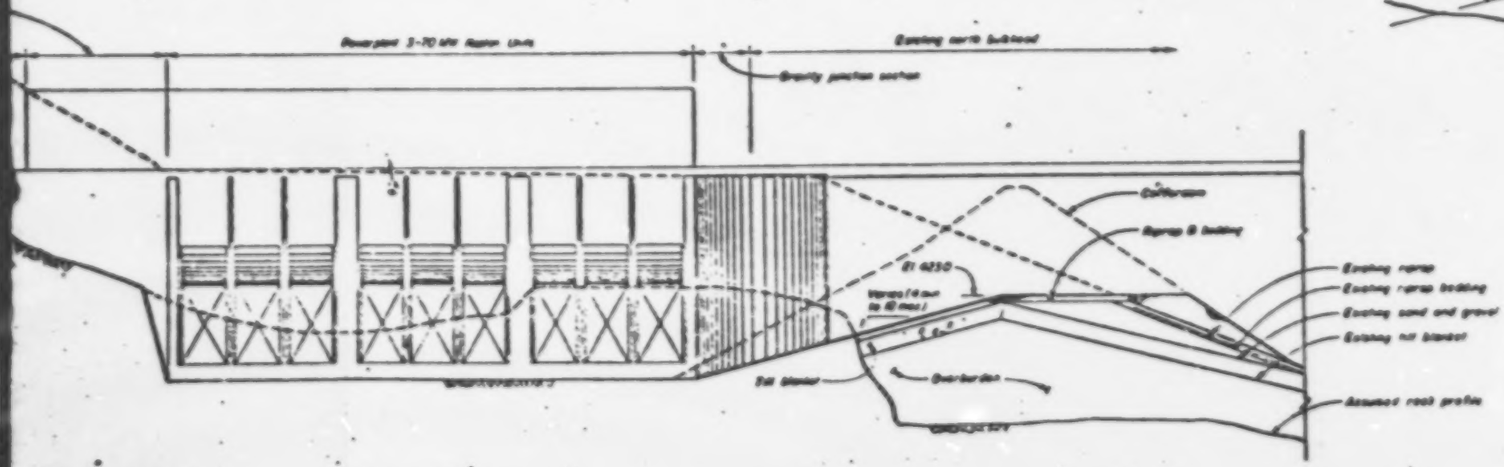


SECTION (5/3-1)
UPSTREAM COFFERDAM



SECTION (12/3-1)
DOWNSTREAM COFFERDAM



SECTION (6/3-1)

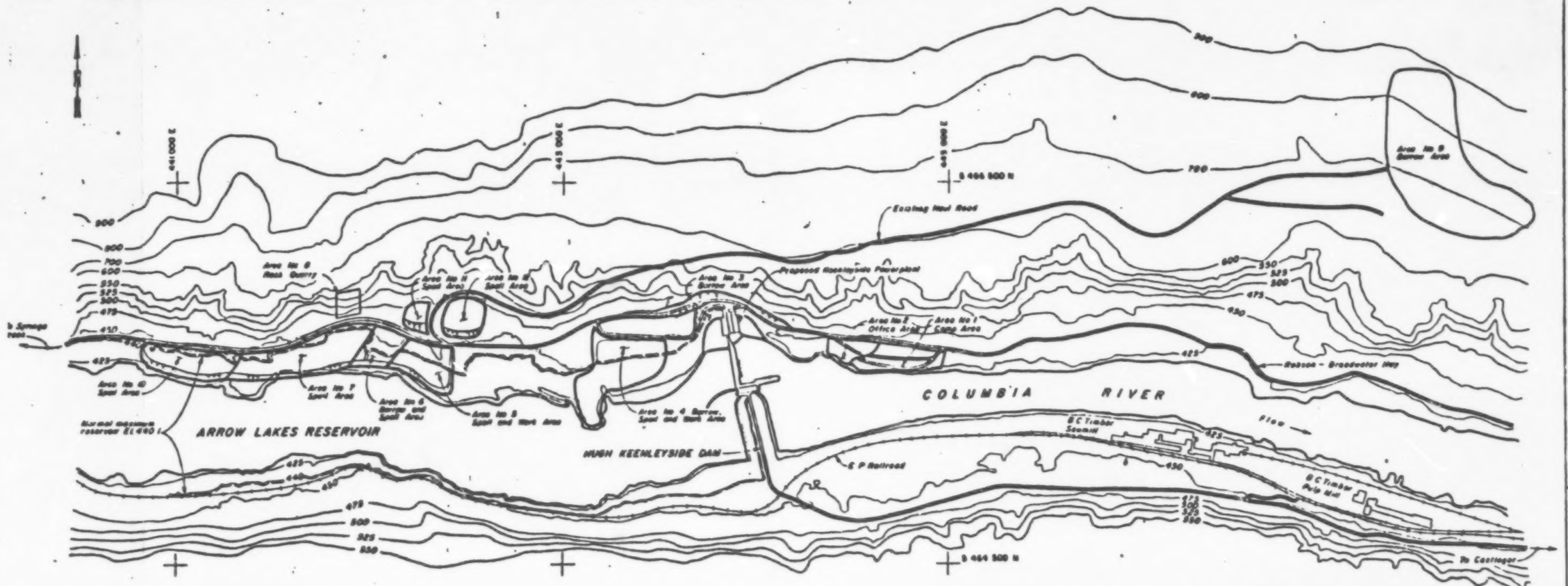
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

KEENLEYSIDE POWERPLANT PROJECT

POWERPLANT & COFFERDAMS SECTIONS

DATE	NOV. 1982	FIG. 3-4.	R
DRN	F.L./S.M.	DWG No.	240-C14-U171

REPORT No. 1540


ARROW LAKES RESERVOIR
HUGH KEENLEYSIDE DAN
COLUMBIA RIVER
Area No. 6 Rock Quarry
Area No. 7 Spoil Area
Area No. 8 Borrow and Spoil Area
Area No. 9 Borrow Area
Area No. 10 Spoil Area
Area No. 11 Spoil Area
Area No. 12 Spoil Area
Area No. 1 Camp Area
Area No. 2 Office Area
Area No. 3 Borrow Area
Area No. 4 Borrow, Spoil and Work Area
Area No. 5 Spoil and Work Area
Proposed Keenleyside Powerplant
Existing Haul Road
C P Railroad
B C Timber Sawmill
B C Timber Pulp Mill
To Castlegar
Robson - Brilliant Ferry
Normal maximum reservoir EL 440 ft
441 000 E
443 000 E
445 000 E
5 466 500 N
5 464 500 N

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

KEENLEYSIDE POWERPLANT PROJECT

POTENTIAL AREAS FOR CONSTRUCTION FACILITIES

DATE NOV. 1982	FIG 3-5	R
DRAWN SM	DWG No. 240-C14-D173	

REPORT No. 81868

POOR

QUALITY

ORIGINAL